IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

CIF LICENSING, LLC, d/b/a GE LICENSING	)	C.A. No. 07-170 (JJF)
Plaintiff,	)	**PUBLIC VERSION**
v.	)	
AGERE SYSTEMS INC.,	)	
Defendant.	)	

PLAINTIFF CIF LICENSING, LLC, d/b/a GE LICENSING'S
RESPONSIVE CLAIM CONSTRUCTION BRIEF

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Pursuant to the Court's September 19, 2007 Scheduling Order (D.I. 32), Plaintiff CIF Licensing, LLC ("GE Licensing") submits this Responsive *Markman* brief in support of its proposed construction of fifteen (15) terms[1] from the asserted claims of U.S. Patent Nos. 5,048,054 ("the `054 Patent"), 5,428,641 ("the `641 Patent") and 6,198,776 ("the `776 Patent") (collectively, along with U.S. Patent No. 5,446,758, the "Asserted Patents"). Copies of the Asserted Patents were attached as Exhibits A-D under Tab 1 (Exhibits) (D.I. 90) to GE Licensing's Opening *Markman* Brief (D.I. 89) (filed April 28, 2008) (hereinafter cited to as "D.I. 89").[2]

I. INTRODUCTION

Agere's opening claim construction brief (hereinafter cited to as "D.I. 87") is virtually devoid of citations to support its proposed constructions. Instead, Agere relies on *ipse dixit* statements and incorrectly stated or applied claim construction principles. As but one example, Agere states that it "has based its constructions entirely on intrinsic evidence" (D.I. 87 at 2), but fails to make a single citation to the specification of the '054 Patent in support of its proposed construction of any of the claim terms at issue, and attaches *extrinsic* evidence in the form of an exhibit from the Wiley Electrical and Electronics Engineering Dictionary as purported support for its construction of several terms. In addition, Agere peppers its brief with unsupported allegations of the purported knowledge of those of ordinary skill in the art. The lack of citation to support its proposed construction is wholly inconsistent with Agere's assertions that all of the

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[1] All these terms were initially proposed by Agere for construction. In addition, the parties have proposed agreed-upon constructions for four terms.

[2] Exhibits A-P were filed with GE Licensing's Opening Brief on April 28, 2008 (D.I. 89-91). Attached to this Responsive Brief are Exhibits Q, R, S, and T.

patents-in-suit "are highly technical and use a vernacular unique to the art of signal processing and modem technology" and that the "vernacular involve[s] terms that have very different meanings outside of the modem field" (D.I. 87 at 1). Agere's statements support rejection of Agere's construction positions because they are bare allegations of how such "vernacular" should be construed and are not based on evidence.

Accordingly, the plain and ordinary meaning of certain terms (supported by the intrinsic record cited by GE Licensing) should control over the unsupported and baldly self-serving constructions proposed by Agere. Agere should not be permitted to exclude technology (general microprocessors and digital signal processors) commonly used in modems by inserting unstated limitations such as "hardware device" and unstated component exclusions, simply because Agere wishes they were there. Agere's attempt to take software or firmware implementations out of the ambit of the claims is not based on evidence and is inconsistent with the knowledge and understanding of ordinarily skilled artisans, a point on which GE ***has*** submitted evidence.[3] Likewise, the Court should reject Agere's repeated attempts to import limitations into the claims from the specification and from Agere's convoluted view of the patent drawings. Furthermore, Agere's position that certain preambles are limiting lacks any merit, as demonstrated by Agere's failure even to offer a justification for its position. Nor is there any explanation that could justify acceptance of the several Agere constructions that are simply nonsensical, verbose, and superfluous.

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[3] If Agere had any evidence on this issue the time for its submission has passed. Any evidence which Agere might now belatedly attempt to submit should be stricken.

II. AGERE MISSTATES BASIC CLAIM CONSTRUCTION PRINCIPLES

A. Use of Extrinsic Evidence in Claim Construction

Agere states that "the Federal Circuit has made clear that the use of intrinsic evidence is to be favored to the virtual exclusion of extrinsic evidence" (D.I. 87 at 3), relying heavily on *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). But *Phillips* says no such thing. Indeed, *Phillips* describes how to use extrinsic evidence in a case such as this one where Agere admits the field of art is highly technical and has a unique vernacular:

> In many cases that give rise to litigation, . . . determining the ordinary and customary meaning of the claim requires examination of terms that have a particular meaning in a field of art. Because the meaning of a claim term as understood by persons of skill in the art is often not immediately apparent, and because patentees frequently use terms idiosyncratically, the court looks to "those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean." [*Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)]. Those sources include "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." *Id.*

Phillips, 413 F.3d at 1314 (other citations omitted).

Several types of terms are in dispute in this case: terms of art in the modem field, general engineering terms, terms specific to the patent, and everyday terms. Examples of terms of art in the modem field are "constellation," "constellation switching," "analog PCM modem," and "upstream PCM data transmission." Examples of general engineering terms are "receiver," "selector," and "quantization device." Examples of terms specific to the Asserted Patents are "line probing processor," "frame selector," "zero insertion unit," and "signal constellation selector/mapper." Examples of everyday terms are "can be" and "for selecting one of . . . ."

A patent is not required to repeat information known to all in the relevant field of art and, in fact, "preferably omits, what is well known in the art." *Hybritech, Inc. v. Monoclonal*

Antibodies, Inc., 802 F.2d 1367, 1384 (Fed. Cir. 1986). Instead, certain terms of art or general engineering terms are used by patentees with the accepted and customary meanings in the art. It is these terms where extrinsic evidence, including expert testimony or technical dictionaries, can be useful.

III. PROPOSED CONSTRUCTION OF CLAIM TERMS

A. U.S. Patent 5,048,054 – the "Line Probing" Patent

1. Agere Improperly Imports Claim Limitations From A Theoretical Figure Not Found In The '054 Patent

Agere's position that the terms of the '054 Patent should be limited to physically separate hardware devices has no basis in law or fact and should be rejected. Agere's proposed constructions are improperly founded upon Agere's unsupportable theory that claims should be limited to the patent figure selected by Agere.

Agere takes the position that Figure 1 of the `054 Patent shows "a structural view of the modem disclosed . . . ." (D.I. 87 at 9.) Agere further contends that certain blocks in Figure 1 show a "discrete component." (*Id.* at 10.) But there is no language in the '054 Patent that indicates Figure 1 is in any way intended to be either (i) the sole embodiment of the invention or (ii) a circuit-level schematic. Figure 1 is described in the '054 Patent specification as "a block diagram of a communication system which embodies the invention." '054 Patent, col. 4:11-12. A "block diagram" is not, as Agere contends, a circuit-level schematic. Figure 1 is, as described in the '054 Patent, a diagram showing the functional operation of one embodiment of the claimed invention. *Id.* Further, Agere's reading would transform Figure 1 from being representative of "<u>a</u> communication system" into a drawing of "<u>the one and only</u> communication system." *See* '054 Patent, col. 4:11-12.

Moreover, the Federal Circuit has repeatedly held that patent drawings "are not meant to represent 'the' invention or to limit the scope of coverage defined by the words used in the claims themselves." *Gart v. Logitech, Inc.*, 254 F.3d 1334, 1342 (Fed. Cir. 2001); *see also TI Group Auto. Sys., Inc. v. VDO (N. Am.), LLC*, 375 F.3d 1126, 1136 (Fed. Cir. 2004) (stating, "we have held that 'the mere fact that the patent drawings depict a particular embodiment of the patent does not operate to limit the claims to that specific configuration'" (quoting *Anchor Wall Sys., Inc. v. Rockwood Retaining Walls, Inc.*, 340 F.3d 1298, 1306-07 (Fed. Cir. 2003))); *MBO Labs., Inc. v. Becton, Dickinson & Co.*, 474 F.3d 1323, 1333 (Fed. Cir. 2007) ("patent coverage is not necessarily limited to inventions that look like the ones in the figures"). Agere presents no reason why this well-established rule should be ignored.

2. Proposed Constructions

a. "receiver" (claims 1, 12, 46)

GE Licensing's Proposed Construction	Defendant's Proposed Construction
Plain meaning (which is *structure capable of receiving an electrical signal*)	*a hardware device for accepting signals from a remote device*

The plain meaning of the term "receiver" as used in claims 1, 12 and 46 is *any structure capable of receiving an electrical signal*. Agere's proposed construction injects nonsensical limitations ("from a remote device") and blatantly improper limitations ("hardware device").[4]

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[4] Agere's construction is also flawed in that Agere never sets forth what it means by "hardware device." Agere's constructions for certain terms from the `641 Patent also contain the phrase "hardware device" and the specific exclusion "*does not include devices storing or executing software such as a central processing unit ('CPU') or a digital signal processor ('DSP')*." (D.I. 87 at 26) (emphasis added). Thus, the logical conclusion flowing from Agere's position regarding the '641 Patent is that the <u>absence</u> of this extra disclaimer in the `054 construction means that the use of "hardware device" in the '054 Patent <u>does include</u> "devices storing or executing software such as a central processing unit (CPU) or a digital signal processor (DSP)."

(continued...)

Agere's insertion of "from a remote device" is nonsensical, given that the words "sent by a remote device" already appear in Claims 1, 12 and 46 (all of which recite "a receiver for receiving the modulated signal and for receiving a line probing signal sent by the remote device . . ."). '054 Patent, claims 1, 12 and 46. As shown above, adopting Agere's construction would also result in a nonsensical claim. *See Schoenhaus v. Genesco, Inc*, 440 F.3d 1354, 1357 (Fed. Cir. 2006).

Astoundingly, Agere provides absolutely no support for its contention that a "receiver" must be a standalone component "hardware device." (*See* D.I. 87 at 14.) Agere contends that a reader would "infer" this and states, without citation to any portion of the specification or file history, "Figure 1, which is reprinted above, shows a hardware arrangement, and the specification of the '054 Patent consistently refers to the components illustrated on Figure 1 as hardware devices." (*Id.*) Agere provides no citations because the specification of the '054 Patent never uses the term "hardware" or "hardware devices." Agere provides no evidence for either of its imported limitations (that the receiver must be hardware and that it must be a separate component from the other claimed elements). Absent this evidence (which does not exist in any case), Agere's construction fails. The Federal Circuit has rejected similar attempts to import such a physically separate-component limitation, even where the patent at issue specifically "envisioned" such an arrangement. *See NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1309 (Fed. Cir. 2005) (rejecting the defendant's argument that a "receiver" and a "destination processor" must be "separate and distinct"). Agere's contention is further refuted by the fact that

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Id. Agere states just the opposite, however, taking the position that "hardware device" in the '054 Patent excludes "software components that could be executed on a general-purpose processor (such as a digital signal processor, or a computer's general processing unit)." (D.I. 87 at 11.) Agere's proposed construction would introduce nothing but confusion, since it appears that Agere itself cannot agree on a single meaning for "hardware device."

if Figure 1 is a circuit level schematic, it shows that the line probing processor 54 receives only inputs and has no outputs. '054 Patent, Fig. 1. However, the specification clearly states that the line probing processor has outputs:

> The main outputs of the line probing processor are the transmitter and receiver baud rates, Q_1 and Q_2, the transmitter and receiver carrier frequencies, f_{c1} and f_{c2}, the transmitter and receiver bit rates, R_1 and R_2, as well as an error code, which may indicate some unexpected error during the line probing process (such as failure in detecting the line probing signal, failure in synchronization, DPSK transmission error, etc.).

'054 Patent, col. 14:46-54. Further, Figure 2 (which is "a flow chart depicting the operation of the line probing shown in FIG. 1") shows a "receiver" as having the functions of the line probing processor 54. '054 Patent, Fig. 2 and col. 4:13-14. Figure 1 also shows receiver 24 as, potentially, a separate component from adaptive filter 25 and decoder 26, yet the specification clearly states that receiver 24 "includes an adaptive filter 25 followed by a decoder 26." '054 Patent, col. 4:39-44; 4:59-64. These are only inconsistencies if Figure 1 is assumed to be a physical "thing."

As explained above, Figure 1 of the '054 Patent was not intended to be a circuit-level schematic and is not an appropriate basis on which to limit the asserted claims. Even if such an exercise were possible, it would still violate the most basic of claim construction principles. "In examining the specification for proper context, . . . court[s] will not at any time import limitations from the specification into the claims." *Varco, L.P. v. Pason Sys. USA Corp.*, 436 F.3d 1368, 1373 (Fed. Cir. 2006) (citing *CollegeNet, Inc. v. ApplyYourself, Inc.*, 418 F.3d 1225, 1231 (Fed. Cir. 2005)); *accord Kwitek v. Pilot Corp.*, 516 F. Supp. 2d 709, 719 (E.D. Tex. 2007) ("Claims should be read broadly, and additional limitations should not be imported from the specification, and certainly not from [the] description of the preferred embodiment."). Agere's

attempt to read out its own products (which employ general microprocessors and DSPs) is unsupportable and legally improper.

GE Licensing's construction is the only construction consistent with the intrinsic record, as detailed in GE Licensing's Opening Brief. (D.I. 89 at 14-15.) Further, GE Licensing's construction is the only construction consistent with the understanding of one of ordinary skill in the art.[5] One of ordinary skill in the art at the time of the invention would have known that a "receiver" as used in the asserted claims is nothing more than a structure that can receive electrical signals. *See* Declaration of Dr. Harry V. Bims in Support of Plaintiff CIF Licensing, LLC, d/b/a GE Licensing's Opening Claim Construction Brief (hereinafter "Bims Decl."), ¶ 28, April 28, 2008 (D.I. 92). As Agere's 30(b)(6) witness on technical issues agreed, [redacted] One of ordinary skill in the art at that time was aware that multifunction general processors and digital signal processors are programmed to perform receiver functions. *See* Bims Decl. ¶¶ 29-31 (D.I. 92).

Agere can point to no clear disavowals of whatever Agere believes is not included in its proposed use of "hardware device."[6] In fact, Agere provides no legally cognizable evidence supporting its position on this term whatsoever. In contrast, GE Licensing's proposed

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[5] For selected terms, Agere has cited the 2004 edition of the Wiley Electrical and Electronic Engineering Dictionary. Not surprisingly, Agere did not choose to include this dictionary's definition of "receiver," which is entirely consistent with GE Licensing's position: "[a] component, device, piece of equipment or system which accepts information-bearing signals . . . ." Exhibit Q, Wiley Electrical and Electronic Engineering Dictionary 641 (Steven Kaplan ed., Wiley-IEEE Press 2004).

[6] Agere's curious footnote 45 in its opening brief points to certain language in a patent filed by a different inventive entity, four years after the '054 Patent, and argues that such language somehow supports Agere's position. (D.I. 87 at 14 n.45.) Agere has no legal or logical support for any such "limitation by exclusion" principle.

construction is logically supported and consistent with knowledge of ordinarily skilled artisans. Therefore, GE Licensing's proposed construction should be adopted by this Court.

b. **"line probing processor" (claims 1, 12, 46)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
structure that processes a line probing signal	*a hardware component that processes a line probing signal*

The only dispute between the parties on this term is over Agere's attempt to again fabricate a limitation ("hardware component").[7] <u>Here again, Agere provides no citations to the specification or file history in support of its position</u>. (*See* D.I. 87 at 14-15.) Agere merely states that "a fair reading of the specification of the '054 Patent requires the inference that the line probing processor is a hardware device separate from the receiver." (*Id.*) Agere provides no citation or explanation as to how such a conclusion could be made. Agere then admits that "the term 'processor' itself connotes a microprocessor device." (*Id.*) But, in a confusing (and unsupported) turn, Agere apparently reads out any device that can run software on that microprocessor.

GE Licensing has injected no such inconsistencies into its proposed construction for "line probing processor" – *structure that processes a line probing signal*. This structure includes hardware devices and hardware devices that execute software. The specification generically describes a "line probing processor" as structure which is capable of "measuring characteristics of the channel based upon the received line probing signal." '054 Patent, claims 1, 12 and 46;

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[7] Agere provides no clarity as to how one of ordinary skill in the art (or the jury) is to draw a distinction between "component" as used in its construction of "line probing processor" and "device" as used in its construction of "receiver."

see also id., col. 4:67-5:4; 5:62-8:38. As already discussed, Figure 1 of the '054 Patent is a functional block diagram. The specification states,

> The main outputs of the line probing processor are the transmitter and receiver baud rates, Q_1 and Q_2, the transmitter and receiver carrier frequencies, f_{c1} and f_{c2}, the transmitter and receiver bit rates, R_1 and R_2, as well as an error code, which may indicate some unexpected error during the line probing process (such as failure in detecting the line probing signal, failure in synchronization, DPSK transmission error, etc.).

'054 Patent, col. 14:46-54.

Agere's proposed construction is also inconsistent with the understanding of one of ordinary skill in the art at the time the application for the '054 Patent was filed. *See* Bims Decl. ¶¶ 33-35 (D.I. 92). One of ordinary skill in the art at the time of the invention would have understood that "line probing processor" refers to any structure that processes a line probing signal. *Id.* Such a "structure" includes a computing device programmed with software to perform a function. *Id.*; *see also* [redacted].

Once again, in contrast, GE Licensing's proposed construction is logically supported and consistent with the knowledge of ordinarily skilled artisans. Therefore, GE Licensing's proposed construction should be adopted by this Court.

c. **"selector" (claims 1, 12, 46)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
Plain meaning (which is *structure that runs a decision algorithm*)	"Invalid based on indefiniteness (35 U.S.C. § 112, ¶ 1); invalid based on lack of enablement (35 U.S.C. § 112, ¶ 2)."

Agere's position that "selector" has no discernable meaning and is not enabled is without basis and should be rejected in favor of GE Licensing's position that plain meaning, *structure that runs a decision algorithm*, should be adopted. Given Agere's penchant for construing terms without the aid of citations to the specification (*see* the "receiver" and "line probing processor"

sections above), it should have had no trouble construing "selector."[8] Agere's sole support for its position appears in the following statements in its opening brief:

> It is also worth noting that neither Figure 1 nor any other figure in the '054 Patent depicts any structure labeled "selector." In fact, the specification of the '054 Patent includes no mention of a "selector," other than in the claims and in the "summary of the invention," which, as noted above, merely parrots the claims. Nothing in the summary section (or any other section of the '054 patent) provides any disclosure that would enable the reader to ascertain what constitutes the "selector" within the meaning of the claims.

(D.I. 87 at 11.) Agere not only returns to its improper argument that the claimed invention must be limited to Figure 1, it goes further to state that the absence of a specific word from the figure is sufficient evidence to render the term indefinite and not enabled.

"Selector" is used in claims 1, 12 and 46 consistent with its plain meaning, *i.e.*, *structure that runs a decision algorithm*. Contrary to Agere's contention, in the context of one of the preferred embodiments, the specification specifically discloses the implementation by the line probing processor of a decision or choosing algorithm to perform the selecting, stating that "Modem 2 then executes a final decision algorithm to select the carrier frequencies baud rates and bit rates to be used for communication over channels A and B (step 220)." '054 Patent, col. 14:1-4; *see also id.* col. 14:8-53. Agere ignores this passage since it contradicts two of its core arguments: (i) that "selector" is indefinite and not enabled and (ii) that the claimed elements must be separate hardware components.

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[8] Agere's dictionary of choice, the 2004 edition of the Wiley Electrical and Electronic Engineering Dictionary, defines "selector" as "[t]hat which serves to choose from multiple positions, options, operational modes, channels or the like." Exhibit Q, Wiley Electrical and Electronic Engineering Dictionary 692 (Steven Kaplan ed., Wiley-IEEE Press 2004). This definition is entirely consistent with GE Licensing's position.

Accordingly, Agere's position that "selector" has no discernable meaning and is not enabled is utterly without foundation and should be rejected in favor of GE Licensing's construction. One of ordinary skill in the art at the time the application for the '054 Patent was filed would have understood that "selector" refers to any structure that runs a decision algorithm. *See* Bims Decl. ¶¶ 38-39 (D.I. 92).

d. **"for selecting one of the plurality of frequency bands" (claims 1, 12)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
Plain meaning (that is, it cannot be broken down any more).	*for determining a frequency band to be used for receiving a modulated signal from the remote device, based upon the channel characteristics measured by the line probing processor*

e. **"for selecting one of the plurality of bit rates" (claim 46)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
Plain meaning (that is, it cannot be broken down any more).	*for determining a bit rate to be used for receiving a modulated signal from the remote device, based upon the channel characteristics measured by the line probing processor*

The common phrase "for selecting one of" requires no construction beyond its plain meaning of "for selecting one of." Agere has failed to provide any citations to the intrinsic evidence or any extrinsic evidence which contradicts the evidence set forth in GE Licensing's Opening Brief.[9]

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[9] The '054 Patent describes a "selector" in preferred embodiments. '054 patent, col. 2:2-3; 2:52-53; and 3:51-52. The specification also discloses the implementation by the line probing processor of one embodiment of a decision or choosing algorithm to perform the selecting, stating that "[m]odem 2 then executes a final decision algorithm to select the carrier frequencies baud rates and bit rates to be used for communication over channels A and B (step 220)." '054 Patent, col. 14:1-4, *see also id.*, col. 14:8-53. The specification also states that, in one

(continued...)

Agere's proposed constructions for these phrases are convoluted and incorrect. To justify its offer of a construction for terms with such plain meaning, Agere cites two reasons: (i) yet another term, *which is not at issue between the parties*, is purportedly "somewhat ambiguous" and (ii) similar claim terms should be interpreted similarly.

Addressing the first basis, Agere oddly supports its construction by asserting that the "term 'measured characteristics of the channel' is somewhat ambiguous." (D.I. 87 at 16.) Neither party proposed construing the term "measured characteristics of the channel." If Agere believed that term was "somewhat" ambiguous, why did Agere not propose it for construction? The answer is not found in Agere's brief. Agere's logic is unsupported by any citation to intrinsic (or extrinsic) evidence.

As for Agere's second basis, even though claims 1 and 12 are different, Agere rewrites claim 12 to include a phrase found in claim 1, "to be used for receiving the modulated signal from the remote device." (D.I. 87 at 17.) As with its other construction positions, Agere provides no legal or factual support for this conclusion. This merely highlights the effect of Agere's confusing approach to claim construction – including in its proposed constructions the phrases which follow the disputed phrase. To make its construction "work," Agere imports limitations from other claims and wipes away claim differentiation. To overcome the presumption of claim differentiation (which Agere's construction must do to be adopted), Agere must cite evidence. *See Kraft Foods, Inc. v. Int'l Trading Co.*, 203 F.3d 1362, 1368 (Fed. Cir. 2000) ("the written

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embodiment, "the modem further includes logic for selecting one of the plurality of different bit rates based upon the measured characteristics of the receiver channel...." '054 Patent, col. 3:6-12; *see also id.*, col. 3:41-55.

description and prosecution history overcome any presumption arising from the doctrine of claim differentiation"). Agere has cited nothing.[10]

The Federal Circuit has stated that substituting a proposed construction into the claim itself is a simple and effective test to determine whether a claim construction is nonsensical. *Schoenhaus*, 440 F.3d at 1357 (finding that "plaintiffs' proposed definition will only hold if, substituting either of the two proffered meanings in place of the phrase [to be construed], [the claim] makes sense"). As stated in GE Licensing's Opening Brief, it bears reviewing the effect of Agere's confused efforts to construe claim 1. As can be seen in the table, phrases with the same color/underline style are redundantly imported wholesale into Agere's definition from claim 1 itself, and the phrase "by the line probing processor" is plucked from thin air.

Clause proposed by Agere for construction	Agere's proposed construction	How Claim 1 would read with Agere's definition inserted
a selector *for selecting one of the plurality of frequency bands*, said selection being based upon the measured characteristics of the channel, said selected frequency band to be used for receiving the modulated signal from the remote device	"*for determining a frequency band to be used for receiving a modulated signal from the remote device, based upon the channel characteristics measured by the line probing processor*."	a selector *for determining a frequency band to be used for receiving a modulated signal from the remote device, based upon the channel characteristics measured* ***by the line probing processor***, said selection being based upon the measured characteristics of the channel, said selected frequency band to be used for receiving the modulated signal from the remote device

[10] Indeed, Agere ignores cases such *Epcon Gas Sys., Inc. v. Bauer Compressors, Inc.*, 279 F.3d 1022, 1032 (Fed. Cir. 2002) (construing same term differently in different claims when terms are used in different ways).

Agere's proposed constructions are redundant of the claim language itself and as such are "nonsensical" and should be rejected – a jury would be left thoroughly confused by this repetitive and verbose construction. GE Licensing's proposed constructions are supported and clearly more logical, and should be adopted.

B. U.S. Patent 5,428,641 – the "Zero Padding" Patent

1. Agere's Description of the '641 Patent is Unnecessarily Limiting

As above, Agere takes a single diagram from the specification and bases its whole claim construction theory on it. Unfortunately for Agere, the diagram does not support its single-minded theory. Agere calls Figure 5 "significant" (D.I. 87 at 19) to the issue of claim construction, and states that it "illustrates the hardware components of the '641 Patent." (*Id.*) But Figure 5 does no such thing. Instead, Figure 5 shows *blocks* within a *block diagram* that demonstrate how an apparatus may be designed "in accordance with an embodiment of the present invention." '641 Patent, col. 2:38-40. There is no restriction on Figure 5 that these blocks *must* be implemented in hardware.

Agere then describes Figure 5 and its impact on the meaning of the claims by describing what the figure and the patent *do not* explicitly say, and extending that into a negative limitation:

> Notably, neither Figure 5 nor any other figure in the '641 Patent, nor, for that matter, any of the description in the '641 Patent, indicates that the components labeled "frame selector," "zero insertion unit," and "signal constellation selector/mapper" might be combinable into a single device or implemented as software running on a common device.

(D.I. 87 at 20.) Agere's logic is backward. "Claims should be read broadly, and additional limitations should not be imported from the specification, and certainly not from [the] description of the preferred embodiment." *Kwitek v. Pilot Corp.*, 516 F. Supp. 2d 709, 719 (E.D. Tex. 2007). Moreover, the description of Figure 5 as "an embodiment" including the above-

described blocks exactly indicates that those blocks are "combinable into a single device" or operable "on a common device."

2. GE Licensing's Constructions Do Not Improperly Limit The Claim Terms

a. "constellation" (claims 1, 3, 5, 7)

GE Licensing's Proposed Construction	Defendant's Proposed Construction
a finite set of points in a space	*the set of 2^n multi-dimensional signal points used to represent a mapping frame of n input data bits*

The parties agree that the term "constellation" is a term of art in the modem field. Agere even calls it "a term of art unique to modem signal processing and modems." (D.I. 87 at 21.) As such, it may be defined with reference to how one of ordinary skill in the art would understand the term in the modem field. In its opening brief, GE Licensing showed how Agere's expert Steven Tretter defined the term, before Agere's litigation-induced wordsmanship, as "a finite set of points selected from an *N*-dimensional space," where "N" can be any positive integer, Steven A. Tretter, *Constellation Shaping, Non-Linear Precoding and Trellis Coding for Voiceband Telephone Channel Modems* 25 (2002) (Exhibit E) (D.I. 90), and explained that the words "N-dimensional" can be removed from the construction because that mathematical nuance is unnecessary to resolve any issues in the case, so there is no need to burden the jury with it. This construction is in line with the specification, which provides examples of "constellations," but does not seek to limit the term's meaning.

In contrast, Agere abandons its expert's general definition of "constellation" and limits it in unnecessary ways, adding the limitations "2^n," "multi-dimensional," and "represent a mapping frame of n input data bits." The limitation "2^n" is unnecessary because the specification explicitly states (as Agere quotes on page 22 of its brief) that a signal constellation has "at least

2^J possible signal point combinations" ("J" in the patent is equatable to "n" in Agere's definition). '641 Patent, col. 4:31-32. "At least 2^J" is certainly not the same thing as 2^J, and nothing in the specification limits the constellations to a power of 2.

The limitation "multi-dimensional" is unnecessary because there are single-dimensional constellations. *See* Bims Decl. ¶ 46 (D.I. 92); [redacted]. While the patentee does discuss multi-dimensional constellations, there is no indication that the patentee limited the well-known term "constellation" to more than one dimension.

Finally, the words limiting a "constellation" to "represent[ing] a mapping frame of n input data bits" are also unnecessary. Constellations are mathematical constructs that represent symbols, '641 Patent, col. 1:33-34; Bims Decl. ¶ 45 (D.I. 92), and there is no need to limit such representation to mapping frames.

Agere admits that its construction is not true to the patent, since it states that a definition of constellation is "apparent" and twice states that another definition is "implied." (D.I. 87 at 21-22.)[11] To arrive at such an *implication*, Agere explicitly cites an "example" of a constellation (in this case, a quadrature-amplitude modulation (QAM) scheme). '641 Patent, col. 1:28. Agere's extension of an explicit example to an implicit limiting definition is improper and without basis in the specification. *See, e.g., NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1310 (Federal Circuit case law "requires a textual 'hook' in the claim language" to impose limitations drawn from statements in the specification).

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[11] Extending its implied definition, Agere contradictorily states that a "different and *more specific* definition of the term 'constellation' becomes apparent," even though the "inventor *expands* his use of the term 'constellation." (D.I. 87 at 22) (emphasis added). Agere never explains how a term can both be "more specific" (*i.e.*, limited) and "expanded" at the same time.

Agere then further confuses the construction of the term "constellation" by discussing that there may be different numbers of "possible signal points used to represent a frame of data bits" (D.I. 87 at 22), *e.g.*, J and J-1, but misleadingly states that it is *simplifying* the possibilities of using J or J-1 and replacing those numbers with "n." Not only is this explanation unnecessarily confusing, it is wrong. Agere attempts to explain the term "constellation" by referring to a "constellation switching" technique (which is another disputed term) (D.I. 87 at 23), but the patent explicitly states that "only one signal constellation is selected that is suitable for mapping J bits/frame," and that one "constellation has at least 2^J possible signal point combinations" and can be used for frames having "J bits" or "J-1 bits." '641 Patent, col. 4:27-40. The explanation by Agere explicitly contradicts the claim language which claims the use of one constellation for frames of J or J-1 bits. *See* '641 Patent, claims 1, 3, 5, and 7.

Thus, as demonstrated here and in its opening brief, GE Licensing's construction of "constellation" as "***a finite set of points in a space***" is consistent with the term's meaning in the art and the '641 Patent specification and claims, is understandable to a jury, and avoids the fabrications and unnecessary limitations provided by Agere's construction.

b. **"constellation switching" (claims 1, 3, 5, 7)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
The preamble of claims 1, 3, 5, and 7 is not limiting. If the preamble is found to be limiting, "constellation switching" means *a change between two constellations having different numbers of points*	The preamble of claims 1 and 3 is limiting. "constellation switching" means *using constellations with varying numbers of points for mapping multiple frames of data bits*

Agere's argument supporting its construction of "constellation switching," a term which appears only in the preambles of the asserted claims, avoids the foundational issue of whether the

preamble is limiting. By not arguing the foundational issue, Agere appears to concede that it has no reasonable argument as to why the preamble or term should be considered a limitation. *See Symantec Corp. v. Computer Assocs. Int'l, Inc.*, 522 F.3d 1279, 1288 (Fed. Cir. 2008) (stating that when a term appears in a preamble, the court *must* "first determine whether it is in fact a separate limitation").

But that omission is understandable, because there is no reasonable argument as to why the preamble is limiting. Agere cites three lines of the Background of the invention section, only to conclude that the definition of the term "constellation switching" is "apparent." (D.I. 87 at 23 (citing '641 Patent, col. 1:54-57).) Agere cannot even muster enough evidence to say that the patentee *explicitly* defines the term.

In sharp contrast, GE Licensing explained in its opening brief why the term "constellation switching" is not limiting – the bodies of claims 1, 3, 5, and 7 are structurally complete and the preamble merely states the intended use of the invention. *Symantec Corp.*, 522 F.3d at 1288; *Catalina Mktg., Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808-09 (Fed. Cir. 2002). In the event, however, that the Court determines the preamble to be limiting, "constellation switching" should be construed to mean *a change between two constellations having different numbers of points*.

Agere's definition of "constellation switching" is incorrect for several reasons. First, it defines the term with respect to the phrase "mapping multiple frames of data," but the specification describes prior art "constellation switching" in terms of mapping both symbols and frames. '641 Patent, col. 1:47-53, 2:16-19, 4:19-24. Second, Agere fails to explain in its brief why it even includes the phrase "for mapping multiple frames of data" in its construction – neither of the words "mapping" or "frame" appears in this section of its brief (and, as said above, there is no

basis for limiting switching to frames as opposed to symbols). Third, Agere's definition includes "using constellations with varying numbers of points." As GE Licensing points out in its opening brief, however, "constellation switching" is more properly defined as changing between two constellations, not encompassing any constellations having varying numbers of points. Finally, the Court must be careful not to import the definition of "constellation switching" into the term "constellation," as Agere appears to be attempting to do. (*See* D.I. 87 at 23.)

Thus, if necessary, a construction of "constellation switching," as found in the preambles of all the asserted claims and which is faithful to the specification is "***a change between two constellations having different numbers of points***."

c. **"can be" (claims 1, 3)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
The preamble of claims 1 and 3 is not limiting. If the preamble is found to be limiting, "can be" should be given its plain meaning (that is, it cannot be broken down any more).	The preamble of claims 1 and 3 is limiting. "can be" means *are* or *must be* As used in the preamble, this term creates a required or limiting condition for the claim. Thus, the phrase "can be transmitted without constellation switching" must be read as "are transmitted without constellation switching."

Agere presents the issue regarding construction of the term "can be" as "whether the preamble limits Claims 1 and 3 of the '641 Patent such that they *must not* include constellation switching." (D.I. 87 at 24) (emphasis added). This misstates the issue by excluding the very inclusive term "can be." Moreover, Agere conflates the preamble-is-limiting inquiry with the absolutist construction of "can be" without separately analyzing both.

First, as described with respect to "constellation switching," the preambles of claims 1 and 3 are not limiting because the bodies of those claims are structurally complete and the preamble merely states the intended use of the invention. *Symantec Corp.*, 522 F.3d at 1288;

Catalina Mktg., 289 F.3d at 808-09. Agere cites to *Catalina* for the proposition that "when the preamble recites 'additional structure or steps underscored as important by the specification, the preamble may operate as a claim limitation.'" (D.I. 87 at 24 (quoting *Catalina Mktg.*, 289 F.3d at 808).) But even accepting Agere's argument that the inventor of the '641 Patent "considered the value of his invention to be its ability to forego constellation switching[,]" (D.I. 87 at 24), the use of the permissive term "can be" does not exclude the possibility that constellation switching could be used in these claims, especially since the inventor did not use the term "can be" in the other two independent claims 5 and 7.[12]

The language used in the specification confirms the still-permitted use of constellation switching, if necessary. Agere cites to the statements in which the inventor states that with his invention, "the implementation difficulties of constellation switching are avoided," and that using the present invention, constellation switching "can be avoided." (D.I. 87 at 25 (quoting '641 Patent, col. 2:25-26)). Agere cites to the statement that this "'scheme is particularly advantageous in that it eliminates the necessity for constellation switching.'" (D.I. 87 at 25 (quoting '641 Patent, col. 2: 51-52)). All of these statements indicate preference, not requirement.

Second, even if the preamble as a whole is determined to be limiting, the term "can be" does not necessarily lose its permissive nature. Again, Agere's citations do not make "can be" into "must," and there is no indication in the prosecution history (much less disavowal) that "can

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[12] Neither of the cases Agere cites is helpful in this context. *Catalina Marketing* did not find the preamble limiting, *Catalina Mktg.*, 289 F.3d at 810, and the preamble in *Corning Glass Works v. Sumitomo Elec., USA, Inc.*, 868 F.2d 1851 (Fed. Cir. 1989), did not include permissive language such as "can be." *See id.* at 1256. Also, the statement Agere quotes from *Catalina Marketing* uses the word "may," which, just like the term "can be," is permissive rather than mandatory.

be" really means "must." Thus, contrary to Agere's position, "can be" means just what it says, "can be."

d. **"frame selector" (claims 3, 7)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
structure that can select the length of data in a frame	*a hardware device for selecting a number of data bits to fill a frame* "Frame selector" does not include devices storing or executing software such as a central processing unit (CPU) or a digital signal processor (DSP).

e. **"zero insertion unit" (claims 3, 7)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
structure that can insert a zero when required	*a hardware device for adding a zero to a frame of data bits* "Zero insertion unit" does not include devices storing or executing software such as a central processing unit (CPU) or a digital signal processor (DSP).

f. **"signal constellation selector/mapper" (claims 3, 7)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
structure that can select a signal constellation and can map frame bits onto constellation points	*a hardware device for selecting a constellation and mapping frames of data bits to signal points or symbols in such constellation* "Signal constellation selector/mapper" does not include devices storing or executing software such as a central processing unit (CPU) or a digital signal processor (DSP).

Without citing any authority, Agere states that the "plain meaning of these [three] terms imply hardware devices." (D.I. 87 at 27.) This is another baseless fabrication. Agere again uses the improper backwards logic (used in its introductory section to the '641 Patent) that if the

specification does not say it can be implemented in software, then it must be implemented in hardware.

The three terms are just blocks in a block diagram of an overall device. The overall device can be a modem, since that is the first exemplary device mentioned in the Background section of the patent and discussed throughout that section. '641 Patent, col. 1:13-63. [redacted] there is absolutely no reason for the '641 inventor in 1993 to disavow software implementations, and Agere can point to no such disavowals. *See also* Bims Decl. ¶¶ 53, 30, 31, and 35 (D.I. 92).

And there is no indication in the '641 Patent that any of the blocks or the device as a whole had to be limited to hardware implementations. To the contrary, the functions performed by the modem in the early 1990s were more likely to be done in software because of the mathematical manipulations required to implement signal constellations in that time period. (*See also* D.I. 89 at 29; Exhibit T (GE000494-502) (discussing the prosecution debate between the examiner and applicant regarding how the functions of the '641 Patent could be and were implemented in software).) But even if this prosecution history evidence did not exist, as GE Licensing stated in its opening brief, having a preferred embodiment that consists of "pure" hardware is no basis for restricting the claim. *Kwitek*, 516 F. Supp. 2d at 719. ("Claims should be read broadly, and additional limitations should not be imported from the specification, and certainly not from [the] description of the preferred embodiment.").

Accordingly, GE Licensing's constructions of "frame selector" as "***structure that can select the length of data in a frame,***" "zero insertion unit" as "***structure that can insert a zero when required,***" and "signal constellation selector/mapper" as "***structure that can select a***

signal constellation and can map frame bits onto constellation points" are the proper ones. Agere's unjustified and more restrictive constructions should be rejected.

g. **"operably coupled" (claims 3, 7)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
whose input is derived from the output of another stage or structure	*physically connected to allow inter-operation*

Agere's argument with respect to "operably coupled" follows close on the heels of its misplaced "hardware" limitations for the previous three terms. Agere again misrepresents Figure 5 of the patent, stating that "the components of Figure 5 are discrete hardware items," and therefore "the only form of coupling between them must be physical connection that allows them to function together." (D.I. 87 at 28.)

No matter how many times Agere says that blocks in a block diagram are hardware components, saying it does not make it so. As discussed above, there is no proper reason to restrict the device of claims 3 and 7 to a hardware implementation, and even less of a reason to restrict the blocks that make up claims 3 and 7 to hardware implementations. Even Agere's dictionary definition does not support its argument. Agere cites the 2004 edition of the Wiley Electrical and Electronics Engineering Dictionary definition of "couple" to include "the transfer of energy." (D.I. 87 at 28 n.75.) First, Agere has cited a 2004 edition of a dictionary for a patent filed in 1993 and issued in 1995. This is improper, since the dictionary definition should be contemporary to the patent itself. *See Inverness Medical Switzerland GmbH v. Princeton Biomeditech Corp.*, 309 F.3d 1365, 1370 (Fed. Cir. 2002). The 1992 version of the Wiley-IEEE dictionary includes an unhelpful definition of "couple" (related to storage cells and thermoelectrics), but does include a definition of "coupling (data transmission)" which reads, "[t]he association of two or more circuits or systems in such a way that power or signal

information may be transferred from one to the other." Exhibit S, IEEE Standard Dictionary of Electrical and Electronic Terms 215 (IEEE Press 1992). This definition clearly supports GE Licensing's construction. Second, any engineer, and most laypeople, know that the transfer of energy does not require physical connections – just consider wireless telephones, which operate *because energy is transferred between devices, yet the phones are not physically connected.*[13] *In* that example, the two phones are "coupled," but not physically connected.[14]

As mentioned in GE Licensing's opening brief, nothing in the claims, specification, or file history contradicts the well-known notion that those skilled in the art were aware that modems have been implemented in hardware, software, and combinations of the two from before 1993 until today. *See* Bims Decl. ¶ 53 (D.I. 92). GE Licensing's construction of "operably coupled" as "***whose input is derived from the output of another stage or structure***" is consistent with the intrinsic and extrinsic evidence and is the proper one.

C. U.S. Patent 6,198,776 – the "PCM Upstream" Patent

1. Agere's Constructions Are Not True To The Understanding Of The Terms In The Patent And The Modem Field

As with its other constructions, Agere continues to ignore how the terms in the '776 Patent are used in the relevant field of modem communications. Its proposed construction of "quantization device" fails to take into account that the device may have both analog and digital

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[13] Solar energy is another type of energy that is transferred without physical connections.

[14] Agere's argument is similar to the one made by the infringer in *Silicon Graphics, Inc. v. nVidia Corp.*, 58 F. Supp. 2d 331 (D. Del. 1999). Several claim elements were coupled—specifically the output was coupled to an interpolator. The defendant argued that "coupled" meant "directly connected" and that "coupled would include, for example, a wire between points A and B with no other components in between." *Id.* at 345. The court rejected the infringer's proposed construction of "coupled" to mean "directly connected" and construed the term to mean "coupled or connected, directly or indirectly." *Id.* at 346.

inputs, and is not necessarily limited to an analog-to-digital converter. Its proposed constructions of "analog PCM modem" and "upstream PCM data transmission" fail to take into account the widespread use of those terms in the art and the patent's adoption of those terms, and presents constructions that do not work technologically in the art.[15]

2. **Proposed Constructions**

a. **"quantization device" (claims 1, 9, 30)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
a device that quantizes a signal	*a device that converts a signal with a continuum of amplitudes to a set of discrete values, including linear, A-law, μ-law or any other analog to digital conversion*

Quantization is the process of rounding an input value to one of a set of discrete output values. Bims Decl. ¶ 57 (D.I. 92). The input set may be analog or it may be digital. For example, the input function could be the set of numbers rounded to the nearest half, *e.g.*, 7.0, 8.5, 6.5, 10.5, which does not have a "continuum of amplitudes" (as proposed by Agere), but if that set of numbers is input to a quantization device that quantizes to the nearest whole number, the output would be 7.0, 9.0, 7.0, 11.0. Thus, a quantization device can also perform a digital to digital conversion. *See* Bims Decl. ¶ 58 (D.I. 92). In general, in quantization, a sampled

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[15] Agere's statement that Figures 16 and 17 are "significant to the issue of claim construction" (D.I. 87 at 30) also demonstrates Agere's lack of understanding of the concepts at issue. The '776 Patent includes at least two embodiments, one in which the analog PCM modem transmits upstream to a digital modem and the other in which the analog PCM modem transmits upstream to another analog modem. The first embodiment is shown in Figures 9-11, whereas the second embodiment is shown in Figures 15-17. *See* '776 Patent, col. 13:38-43. Although the upstream PCM transmission is the same for both embodiments, it is more accurate to use Figures 9-11, as well as Figures 12-14 to understand the concepts in the asserted claims.

continuous signal or a large set of discrete signals is approximated by a small set of discrete symbols or integer values.

On the other hand, Agere's construction that includes "any other analog to digital conversion" is not accurate. It limits the input value to be an analog value, but it is possible that the input to a quantizer does not have a continuum of amplitudes. Agere is correct that the specification uses as examples two specific types of analog-to-digital conversions, A-law and μ-law (D.I. 87 at 33), and that the patent's use of the term "quantization device" is broader than just those two types of analog-to-digital conversion. However, Agere still unnecessarily limits the input to the quantization device to be a "continuum of amplitudes," when the definition of a quantization device does not require such limitations.

In support of its proposed construction, Agere presents extrinsic evidence that demonstrates the danger the *Phillips* court warned about. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (*en banc*) (warning against adopting "a dictionary definition entirely divorced from the context of the written description"). Agere points to a definition of quantization that reads "[t]he division of a quantity or phenomenon, such as a wave, with an infinitely variable range of values into one or more ranges with finites [sic] values, each called a quantized value. For example, the conversion of an analog input to a digital output." (D.I. 87 at 33 n.85 (quoting Exhibit Q, Wiley Electrical and Electronics Engineering Dictionary 619 (Steven Kaplan ed., Wiley-IEEE Press 2004)).[16] But the patent does not have to do with a "wave," as mentioned in the definition. In fact, Wiley's definition number 2 is probably a better definition,

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[16] As noted previously, Agere's citation of a newer dictionary for a patent filed in 1997 and issued in 2001 is immediately suspect. *See Inverness Medical Switzerland GmbH v. Princeton Biomeditech Corp.*, 309 F.3d 1365, 1370 (Fed. Cir. 2002).

yet Agere ignores it.[17] That definition is "The division of a range of values into labeled subranges. For example, any number between 1 and 30 is a, between 31 and 60 is b, between 61 and 90 is c, and so on." Exhibit Q, Wiley-IEEE Press 2004 Dictionary at 619. Even definition number 3 is better: "The description of an interval of values as a discrete number [of] possible values." *Id.* Agere's definition should thus be discounted for failing to properly take into account the terminology from the patent.

Based on these understandings consistent with the use of the word "quantization" in the art, Agere's construction is improper and GE Licensing's construction is correct and preferable.

b. **"Analog pulse code modulation (PCM) modem" (claim 30)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
The preamble of claim 30 is not limiting. If the preamble is found to be limiting, "Analog pulse code modulation (PCM) modem" means *a client-side or end user modem connected to an analog phone line*	The preamble of claim 30 is limiting. "Analog pulse code modulation (PCM) modem" means *a modem that transmits pulse code modulated data over an analog line*

[17] Agere also ignores the arguably more relevant 1992 edition of the Wiley/IEEE Press dictionary, which defines "quantization" as:

> 1. (telecommunication). A process in which the continuous range of values of an input signal is divided into nonoverlapping subranges, and to each subrange a discrete value of the output is uniquely assigned. Whenever the signal value falls within the given subrange the output has a corresponding value."

Exhibit S, IEEE Standard Dictionary of Electrical and Electronic Terms 766 (IEEE Press 1992).

c. **"upstream PCM data transmission" (claim 30)**

GE Licensing's Proposed Construction	Defendant's Proposed Construction
The preamble of claim 30 is not limiting. If the preamble is found to be limiting, "upstream PCM data transmission" means *transmission of analog levels in the direction from an analog PCM modem toward a central office.*	The preamble of claim 30 is limiting. "upstream PCM data transmission" means *transmission of pulse code modulated data to a digital modem*

In construing the terms "Analog pulse code modulation (PCM) modem" and "upstream PCM data transmission," which appear only in the preamble of claim 30, Agere again fails to address whether the preamble itself is limiting. The preamble is as follows:

> In an Analog pulse code modulation (PCM) modem adapted for upstream PCM data transmission to a digital PCM modem, a precoder for prec[o]ding a sequence of analog levels transmitted over an analog channel to a quantization device, comprising:

'776 Patent, col. 17:5-9. As GE Licensing stated in its opening brief, the preamble is not limiting because "In an Analog [PCM] modem" manifests the way to use the invention and "upstream PCM data transmission" merely states what the analog PCM modem is "adapted" for. *Symantec Corp.*, 522 F.3d at 1288; *Catalina Mktg.*, 289 F.3d at 808; (D.I. 89 at 36).

Agere's construction of the terms simply takes the acronym "PCM," states that it stands for "pulse code modulation," and then states without support that "upstream PCM data transmission" *must mean* transmission of pulse code modulated data (D.I. 87 at 33) and "analog pulse code modulation (PCM) modem *must* transmit pulse code modulated data (*id.* at 34). But even though "PCM" does stand for "pulse code modulation," both of Agere's definitions are wrong and contradict both the patent and the industry usage on which the patent language is based. In fact, knowledge of how those (related) terms evolved in modem communications and

are used both in the specification and the relevant field of art is more important than mere substitution of words for an acronym.

Although "PCM" does stand for "pulse code modulation," when "PCM" is combined with "modem" or a transmission direction, it is really a shorthand for "PCM mode" and does not mean that every signal is transmitted using pulse code modulation along the whole transmission path. For example, the specification states that first generation PCM modems "transmit data in PCM mode downstream," and future PCM modems will "transmit data upstream in PCM mode." '776 Patent, col. 1:25-32. These first generation PCM modems, which are typically modems at the central site, were called "PCM modems" because they are digital modems and do transmit pulse code modulated data downstream (that is, toward the analog or end-user modem). *Id.*, col. 1:25-30. However, once the downstream PCM signal (in the form of eight-bit digital words called "octets") encounters the codec in the central office, it is converted to analog levels. *Id.*, col. 1:33-39.

Conversely, upstream signals transmitted over an analog loop (wire) to a telephone company's central office ("CO") from the end user are analog, and are then digitized to pulse code modulated data signals or PCM signals in the central office's codec. *Id.*, col. 1:18-25. The central site modem is called a "PCM modem" and is largely a digital modem, so the industry also called the end-user modem a "PCM modem," *id.*, col. 1:38, even though it does not transmit PCM signals. In order to distinguish the two types of PCM modems, the industry called the

central site modem "digital PCM modem" and the end-user modem "analog PCM modem." *See id.*, col. 7:22-30.[18]

Similarly, "upstream PCM data transmission" is defined in contrast to "downstream PCM data transmission" or "PCM downstream." '776 Patent, col. 1:32. As with "analog PCM modem," which was defined in contrast to the first generation digital PCM modem, digital modems did transmit PCM data downstream from the digital modem to the central office, but once the PCM signal hit the codec in the central office, the signal was converted to analog levels and was no longer PCM data. Nevertheless, the transmission direction remained the same ("downstream") and the transmission was called "PCM downstream" even if the signal was analog. Then, in order to describe the opposite transmission direction, the term "PCM upstream" or "upstream PCM" was developed. *Id.*, col. 1:43. But the industry and the patent are unambiguous that such a term did not mean that PCM data was being transmitted upstream over the analog loop (wire) between the analog PCM (or end-user) modem and the central office; instead, "[w]ith PCM upstream, the end user PCM modem transmits analog levels over the analog loop corresponding to data to be transmitted." '776 Patent, col. 1:43-45. This last line sums up what both "upstream PCM data transmission" and the "analog PCM modem" are.

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[18] As stated in GE Licensing's opening brief, the '776 Patent's use of "analog PCM modem" and "digital PCM modem" to distinguish the two modems comports with the terminology used in the modem field at the time and by Agere's predecessor Lucent Technologies. *See* Exhibit O, Nuri Dagdeviren, "Proposed Baseline for PCM Upstream," (Dec. 4-5, 1996) (GE 000938-949, GE 000939) ("Ad hoc group on PCM modems" used the terminology "analog PCM modem," "analog modem, "digital PCM modem," and "digital modem" to describe the modems in PCM systems); Exhibit P, Bahman Barazesh, "TR30.1 PCM Modem ad hoc meeting report, Irvine, California, Nov. 13-15, 1996" (Nov. 25, 1996) (ASI035010-15, ASI035012) (noting that the ad hoc committee proposed the term "digital PCM modem" to denote the central site PCM modem and the term "analog PCM modem" to denote the "loop side, or client pcm modem") (D.I. 91).

Agere's proposed constructions ignore this industry usage and Agere's predecessor Lucent's usage (*see* note 18) and stubbornly misinterpret the use of the PCM acronym. As stated above, the transmission line between the end-user and the central office is analog ('analog loop"), not PCM, the end-user modem is commonly called the "analog PCM modem," and the transmission direction from the analog PCM modem to the central office is commonly called "upstream PCM data transmission," even though there are no PCM data signals (octets) transmitted on the analog line.[19] Agere's insistence (its repeated use of the word "must" on pages 33 and 34 of its brief) that the acronym "PCM" requires the transmission of pulse code modulated data on an analog transmission line flies in the face of the technology, the patent, and its own engineers.

Thus, as stated in GE Licensing's opening brief, if the preamble of claim 30 is deemed to be limiting, "Analog pulse code modulation (PCM) modem" should be construed as ***"a client-side or end-user modem connected to an analog phone line"*** and "upstream PCM data transmission" should be construed to mean ***"transmission of analog levels in the direction from an analog PCM modem toward a central office."***

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[19] In its brief, Agere misquotes what the "analog PCM modem" is "adapted for," stating that it is "adapted for PCM data transmission," rather than the actual language, "adapted for *upstream* PCM data transmission." (D.I. 87 at 34.) This misquote is crucial, because, as shown in the Background section of the '776 Patent, this technology developed aggregate terms that differ from the meanings of the individual words, so Agere's leaving out the word "upstream" greatly changes the meaning of the aggregate phrase.

IV. CONCLUSION

For the above reasons, GE Licensing respectfully requests that this Court adopt the constructions proffered by GE Licensing in their entirety.

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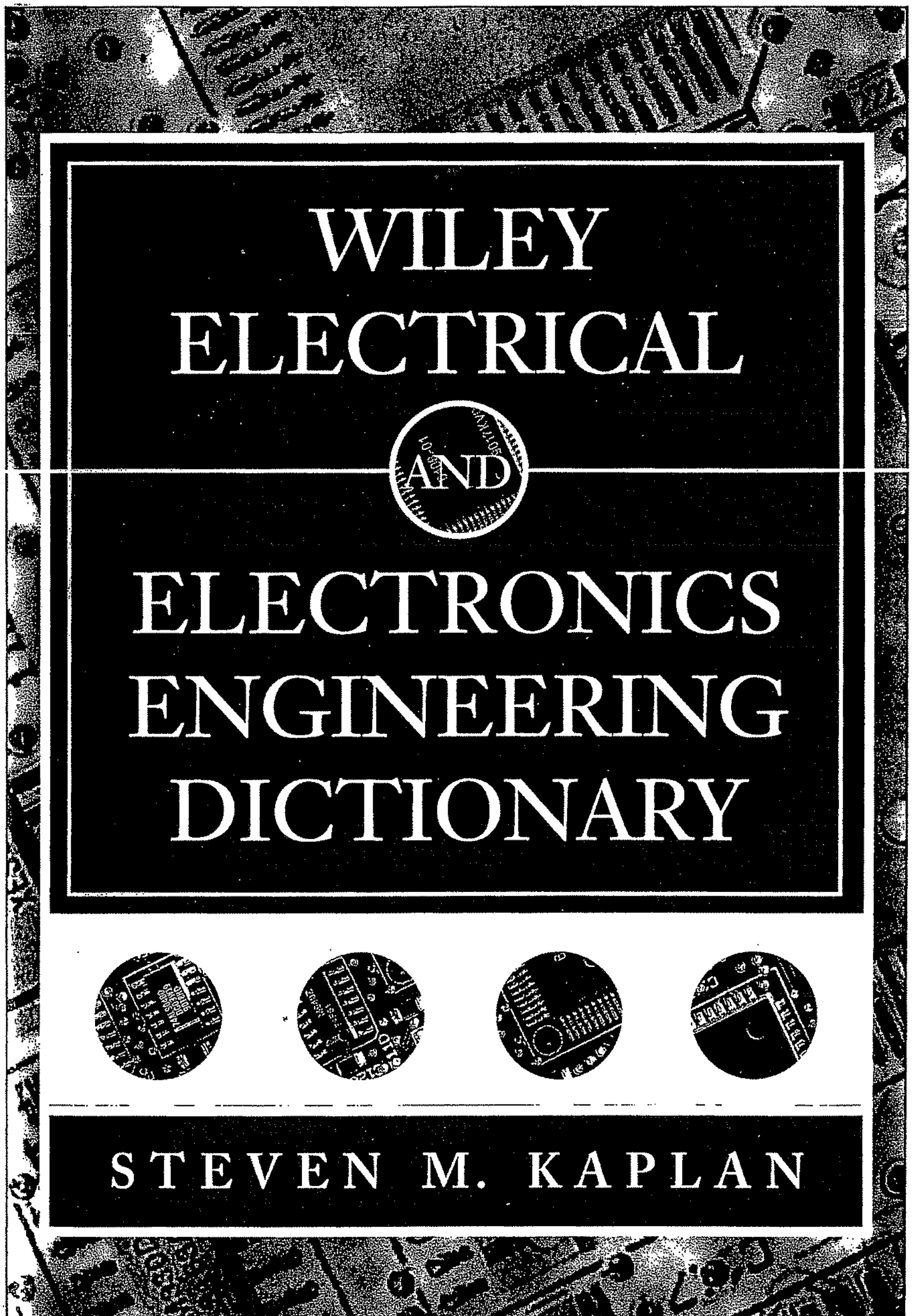
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10 9 8 7 6 5 4 3 2

and in what proportions. A **qualitative analysis** would only determine, for instance, the species present.

quantity Its abbreviation is **qty**. **1.** A number, amount, or value. **2.** A specified number, amount, or value. **3.** A large number, amount, or value. **4.** For a given component, circuit, device, system, material, or the like, a property which is measurable, countable, or can otherwise be expressed as a **quantity (1)**. **5.** An entity which has a value or magnitude, upon which mathematical operations may be performed.

quantization **1.** The division of a quantity or phenomenon, such as a wave, with an infinitely variable range of values into one or more ranges with finite values, each called a quantized value. For example, the conversion of an analog input into a digital output. Since the number of subranges created can not be infinite, there will always be a loss, however minor, of information, called quantization error. **2.** The division of a range of values into labeled subranges. For example, any number between 1 and 30 is **a**, between 31 and 60 is **b**, between 61 and 90 is **c**, and so on. **3.** The description of an interval of values as a discrete number possible values. For example, anything occurring between 12 AM day one and 12 AM day two, being recorded as occurring on day one, regardless of the hour. **4.** The process of applying quantum mechanics or quantum theory to something.

quantization distortion Distortion introduced in the process of **quantization (1)**. This distortion is due to the quantization error present. Also called **quantizing distortion**.

quantization error The information which is lost in the process of **quantization (1)**. This causes noise and distortion. Also called **quantizing error**.

quantization noise Noise introduced in the process of **quantization (1)**. This noise is due to the quantization error present. Also called **quantizing noise**.

quantize **1.** To perform the process of **quantization (1)**, or **quantization (2)**. **2.** To apply quantum mechanics or quantum theory to something.

quantized **1.** That which has undergone the process of **quantization (1)**, or **quantization (2)**. **2.** That which has had quantum mechanics or quantum theory applied to it.

quantized system A system in which only certain allowed energy values may be adopted. Electrons in such a system can only change from one specific level to another, and in the process absorb or emit energy.

quantized value One of the finite values derived from a quantity or phenomenon with an infinitely variable range of values, through the process of **quantization (1)**. Also called **quantum (2)**.

quantizer That which performs the process of **quantization (1)**, or **quantization (2)**. For example, a circuit or device serving as an analog-to-digital converter.

quantizing The process of **quantization (1)**, or **quantization (2)**.

quantizing distortion Same as **quantization distortion**.

quantizing error Same as **quantization error**.

quantizing noise Same as **quantization noise**.

quantum Its abbreviation is **Q**. Its plural form is **quanta**. **1.** For a given physical phenomenon, such as electromagnetic radiation, the smallest quantity, such as that of energy, that can exist independently. For such phenomena, any quantity above this can only exist in multiples of this unit. In the case of light, for, instance, energy can be absorbed or radiated only in multiples of these discrete packages called photons. **2.** A **quantum (1)** utilized as a unit. For example, the quantum of electromagnetic radiation is the photon, which is also called light quantum. **3.** Same as **quantized value**. **4.** Any given quantity which can be counted or measured.

quantum bit Same as **qubit**.

quantum chromodynamics The area of quantum theory dealing with the relationships between quarks, especially the strong interaction via gluons. Its abbreviation is **QCD**.

quantum computer A computer whose basic unit of computing is the **qubit**. A quantum computer operates on all qubits simultaneously, thus is exponentially faster than conventional computers based, for instance, on the charge of a capacitor in RAM or on the magnetization of macroscopic particles on a hard disk.

quantum computing The use of **quantum computers**.

quantum cryptography Cryptography which makes use of quantum mechanics to code information or create keys which are unbreakable. Used, for instance, in one-time pads. Also called **quantum encryption**.

quantum dot A semiconductor structure forming a three-dimensional **quantum well**. Used, for instance, in semiconductor lasers, and to study the behavior of the electrons of atoms so constrained.

quantum-dot laser A semiconductor laser utilizing a **quantum dot**. Such a laser is highly temperature insensitive, provides an extremely broad gain spectrum, and an exceedingly narrow line width.

quantum efficiency Also called **quantum yield**. **1.** The number of electrons released by a photoemissive surface, such as a photocathode, per photon of incident radiation. **2.** The number of photon-induced reactions, per incident photon. For instance, the ratio number of photons emitted by a surface, to the number of photons absorbed.

quantum electrodynamics The area of quantum theory dealing with electromagnetic interactions between elementary particles, such as electrons and muons, especially exchanges of photons. Its abbreviation is **QED**.

quantum electronics The application of quantum mechanics, especially the energy states of matter, to electronics. Applied, for instance, in masers.

quantum encryption Same as **quantum cryptography**.

quantum field theory The area of quantum theory that deals with the quantum-mechanical interactions between elementary particles and fields. An application is quantum electrodynamics. Its abbreviation is **QFT**.

quantum jump A transition or change in energy whose magnitude is a **quantum (2)**. For example, a change in the orbit of an electron in which a quantum is absorbed or emitted. Also called **quantum transition**.

quantum mechanics **1.** The science dealing with the application of quantum theory to the mechanics of elementary and atomic particles and systems. **2.** Same as **quantum theory**.

quantum number A number, with integer or half-integer values, which characterizes a property or state of a particle or system. For example the spin of an electron may be characterized by the quantum numbers $+\frac{1}{2}$, or $-\frac{1}{2}$.

quantum physics The branch of science which utilizes quantum theory to analyze, explain, and predict the physical properties of a system.

quantum state A state in which a particle or system can exist in, according to quantum theory. Such a state is described by quantum numbers.

quantum statistics The application of statistical methods to particles and systems that obey the rules of quantum mechanics. For instance, the distribution of energy levels of the particles of a given system.

quantum system A system which can only be accurately described through the use of quantum physics.

quantum theory The theory according to which energy is emitted or absorbed in discrete units called **quanta**. It describes the behavior of atomic and subatomic particles and systems. According to quantum theory, electromagnetic radiation has both particle-like properties, as seen in the pho-

realtime video conferencing Same as **real-time video conferencing**.

RealVideo A popular format for streaming video.

Réamur scale Same as **Réamur temperature scale**.

Réamur temperature scale An obsolete temperature scale in which water freezes at 0 degrees and boils at 80 degrees. Also called **Réamur scale**.

rear projection The projection, onto a translucent screen, of images sent from a separate unit, and in which the projector and any viewers are on opposite sides of said screen. Used, for instance, in rear-projection TVs. This contrasts with **front projection**, where the images are viewed on a non-translucent screen, and the projector and viewers are on the same side of said screen.

rear-projection television Same as **rear projection TV**.

rear projection TV Abbreviation of **rear-projection television**. A TV with **rear projection**.

rear-surface mirror A mirror whose reflective coating is on its rear surface, as is the case with a household mirror. This contrasts with **front-surface mirror**, in which the reflective coating is on the front surface. Also called **second-surface mirror**, or **back-surface mirror**.

rear wave An acoustic wave which is radiated by the back of a loudspeaker, which can cancel the waves radiated from the front of the loudspeaker. An infinite baffle completely isolates the back waves from the front waves, while a port helps both waves to be in phase. Also called **back wave**.

reassembly In a packet-switched network, the reconstitution of a packet at the receiving end, after **segmentation** at the transmission end. Also spelled **re-assembly**.

rebecca In the **rebecca-eureka system**, the airborne interrogator.

rebecca-eureka Same as **rebecca-eureka system**.

rebecca-eureka system A radar homing system which utilizes an airborne interrogator, called rebecca, and a ground transponder beacon, called eureka. Also called **rebecca-eureka**.

reboot To reset a computer. During this process the computer accesses instructions from its ROM chip, performs self-checks, loads the operating system, and prepares for use by an operator. A rebooting may be initiated by pressing a button or switch, by hitting a specific key sequence, or through a program or routine that gives this command. It is an abbreviation of **rebooting**.

rebooting Same as **reboot**.

rebroadcast Also spelled **re-broadcast**. **1.** To repeat or reemit a broadcast. **2.** A broadcast that is repeated or relayed by a station other than that emitting the original broadcast.

rebuild Also called **reconstruct**, or **remodel**. **1.** To make repairs that are so extensive that it is equivalent to building again. **2.** To build again.

recall **1.** To restore to a former condition. Also, the act of restoring to a former condition. **2.** In computers, a retrieval of information. Also, the act of retrieving information. **3.** To request that a defective manufactured product be returned for adjustment, repair, or disposal. Also, the process of informing of such a recall, and making the changes. **4.** Same as **redial**.

receipt notification A confirmation or notification given to a sender that a given email has been received or opened by a recipient.

received power **1.** The power an antenna receives from a transmitter or other signal source. **2.** The power a device receives from a transmitter or other signal source.

receiver Its abbreviation is **RX**. **1.** A component, device, piece of equipment, or system which accepts information-bearing signals, and which can extract the meaningful information contained. There are many types of receivers, including those utilized in communications, TV and entertainment, radars, and so on. Signals may arrive from land-based antennas, satellites, remote controls, and so on. **2.** A single audio-frequency component which incorporates a preamplifier, a power amplifier, and a tuner. Such a component usually has multiple inputs for CDs, DVD, TVs, tape decks, and so on, and may have circuitry for specialized sound reproduction, such as Dolby surround sound. **3.** Same as **radio receiver**. **4.** A small loudspeaker located in the handset of a telephone, which enables listening. Also called **earphone (3)**, or **telephone receiver (1)**. **5.** That which is a destination or which otherwise accepts signals, energy, particles, waves, or the like, which move from one point to another.

receiver bandwidth **1.** The interval of frequencies within which a receiver can produce a given proportion of its maximum output. Usually calculated at 50% or 90% of full power. **2.** The interval of frequencies within which the performance of a receiver falls within certain limits.

receiver muting In a transceiver or transmitter-receiver, the reduction or silencing of the receiving input while transmitting. This may occur manually or automatically.

receiver noise **1.** The electrical noise generated by a receiver in the absence of an input signal. **2.** Any noise generated by a receiver.

receiver noise factor For a specified bandwidth, the ratio of the total noise output to the total noise input for a given receiver. It is the additional noise a receiver adds to any signal it accepts. Usually expressed in decibels, in which case it is called **receiver noise figure**.

receiver noise figure The **receiver noise factor** expressed in decibels.

receiver off-hook The condition where a telephone is not in use, yet the handset is removed from its cradle. This may occur, for instance, by not hanging up after a call. There is usually a loud warning tone to indicate that this condition exists. Its abbreviation is **ROH**.

receiver primaries Colors which are combined in an additive mixture to yield a full range of colors to be displayed by a color TV receiver. Red, green, and blue are most commonly used as the additive primary colors. Also called **display primaries**.

receiver selectivity **1.** The degree to which a receiver can differentiate between a desired signal and other signals. **2.** The degree to which a receiver rejects the signals of channels adjacent to that which is desired. Also called **adjacent-channel selectivity**.

receiver sensitivity **1.** For a receiver, the minimum input signal level which will produce a discernable output signal. **2.** For a receiver, the minimum input signal level which will produce an output signal with a signal-to-noise ratio equal to or greater than a given value.

receiver set Same as **radio receiver**.

receiver synchro In a synchro system, the synchro which converts the voltage received from the synchro transmitter into the corresponding angular position of its stator. Also called **synchro receiver**.

receiving antenna An antenna which picks up electromagnetic radiation. There are many types of receiving antennas, including those utilized in communications, TV and entertainment, radars, and so on. A single antenna may be able to be used for both transmission and reception.

receiving device A device, such as a GPS Receiver, a beacon receiver, or a receiving fax, which picks up or receives a signal emitted or sent by a transmitting device utilizing the same system.

energies off a surface, object, or region. **3.** The scattering of only certain particles off a surface, object, or region.

selectivity **1.** The ability of a component, circuit, device, piece of equipment, or system, to operate only at a given frequency, or within a given band. Also, the degree to which this selectivity is attained. **2.** The ability of a component, circuit, device, piece of equipment, or system, to distinguish, separate, or otherwise act upon a given frequency or band. Also, the degree to which this selectivity is attained. **3.** Selectivity (1) or selectivity (2) manifested by a radio receiver. An example is adjacent-channel selectivity. Also, the degree to which this selectivity is attained.

selectivity control A control which adjusts the **selectivity** of a component, circuit, device, piece of equipment, or system. For instance, that of a receiver.

selector **1.** That which serves to choose from multiple positions, options, operational modes, channels, or the like. **2.** Same as **selector switch.**

selector channel A channel which connects high-speed peripherals to the memory of a computer.

selector switch A manually operated multi-position switch. Such a switch is usually adjusted by a knob or handle, and may have detents to hold in a given position. Used, for instance, in devices or instruments with multiple functions, ranges, or modes of operation. Such a switch is usually rotary. Also called **selector (2).**

selenium A chemical element whose atomic number is 34. It has several allotropic forms, and may be a red amorphous powder, consist of red crystals, or occur in the form of gray metallic crystals, among others. It has over 25 known isotopes, of which 5 are stable. It has many applications in electronics, including its use in photocells, batteries, rectifiers, TV cameras, photography, and semiconductors. Its chemical symbol is Se.

selenium cell A photocell in which the light-sensitive material is a layer or disk coated with selenium. Used, for instance, in exposure meters. Also called **selenium photocell.**

selenium photocell Same as **selenium cell.**

selenium rectifier A metallic-disk rectifier in which one side of each metal disk is covered with a selenium layer.

self-absorption Absorption of energy, particles, or waves, by the same surface, body, or medium which emitted said energy, particles, or waves.

self-adapting The ability of a component, circuit, device, piece of equipment, system, material, mechanism, or process to adjust its operation or characteristics depending on changing environmental conditions or other variables.

self-adjusting communications Communications utilizing a system that monitors internal and external parameters automatically and continuously in order to makes adjustments to better operate in its varying environment. Also known as **self-optimizing communications,** or **adaptive communications.**

self-alarm A device which automatically generates an alert under certain alarm conditions. For example, a one-way communicator dialing an emergency services number under specified circumstances. Also called **autoalarm.**

self-aligned gate In the fabrication of ICs incorporating MOSFETs, a process in which the gate electrodes are put in place before ion implantations or diffusions of the source or drain are made. Also, the technology employed in such a process.

self-bias In a transistor or vacuum tube, obtaining of the correct bias utilizing a dropping resistor instead of an external bias voltage. Also called **automatic bias (1),** or **automatic grid bias.**

self-booting **1.** A disk which has the necessary components of an operating system for booting a computer. **2.** That which boots a computer automatically. For example, a command which triggers a boot during the installation of an application.

self-capacitance Same as **stray capacitance.**

self-check A mechanism which automatically monitors the operation of a component, device, or system, seeking to maintain performance within specified parameters. May serve, for instance, to detect malfunctions and to optimize performance.

self-cleaning contacts Electrical contacts which wipe or slide past each other, resulting in a cleaning action when used. Also called **self-wiping contacts,** or **wiping contacts (2).**

self-clocking A format or transmission in which clock pulses or other synchronizing information is incorporated into the sent signal. Manchester encoding, for instance, provides a self-synchronizing data stream.

self-contained That which has all the parts necessary to operate as an independent or complete unit. Examples include autonomous robots, external modems, and black boxes. Standardized self-contained units may be used, for instance, in a modular approach.

self-contained device A device, such as a self-contained instrument, which is **self-contained.**

self-contained instrument An instrument which requires no accessories nor external power to perform measurements and indications.

self-contained module A module, such as a resident module, which is **self-contained.**

self-contained unit A unit, such as an external modem, which is **self-contained.**

self-diagnostics Same as **self-testing.**

self-diffusion Diffusion occurring within different regions of the same material. For example, the spontaneous movement of an atom to a new site within the same crystal.

self-discharge The loss of energy of a battery which is in storage or otherwise not connected to a load. The battery chemistry and ambient temperature influence this rate considerably. Also called **battery self-discharge.**

self-discharge rate The rate at which **self-discharge** occurs. Battery chemistry and ambient temperature influence this rate considerably.

self-driven Same as **self-excited.**

self-energy The energy of a particle at rest, according to the mass-energy equation. The self-energy of an electron, for instance, is approximately 0.511 MeV, while that of a proton is approximately 938 MeV. Also called **rest energy.**

self-error correction **1.** In communications, a system which automatically detects and rectifies errors during transmission or reception. **2.** A system which automatically detects and rectifies errors.

self-excited A component, circuit, device, piece of equipment, system, process, or mechanism which provides its own excitation signal. That is, it does not require an external signal, such as a current or voltage, to operate. An example is a self-excited oscillator. Also called **self-driven.**

self-excited oscillator An oscillator which maintains oscillation without the aid of an external signal.

self-extracting An archive, file, program, or the like, which automatically decompresses when run or accessed. Seen, for instance, when downloading an application.

self-extracting archive An archive which is **self-extracting.**

self-extracting file A file which is **self-extracting.**

self-extracting program A program which is **self-extracting.**

self-focus The ability of an optical system or device to automatically make adjustments which improve the sharpness of an image. Seen, for instance, in digital cameras.

EXHIBIT R

THIS EXHIBIT HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT S

ANSI/IEEE Std 100-1988

43

IEEE Standard Dictionary of Electrical and Electronics Terms

Third Printing
March 1992

Library of Congress Catalog Number 88-082198

ISBN: 1-55937-000-9

er or automatic circuit recloser) (power switchgear). A device that counts the number of electrical impulses and, following a predetermined number of successive electrical impulses, actuates a releasing mechanism. It resets if the total predetermined number of successive impulses do not occur in a predetermined time. 103

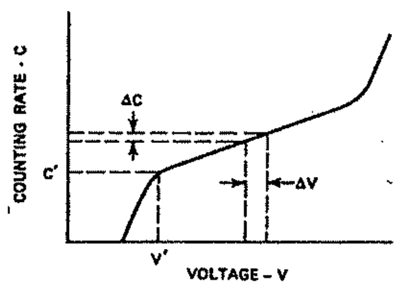
counting operation (of an automatic line sectionalizer or automatic circuit recloser) (power switchgear). Each advance of the counting mechanism towards an opening operation. 103

counting operation time (of an automatic line sectionalizer) (power switchgear). The time between the cessation of a current above the minimum actuating current value and the completion of a counting operation. 103

counting rate. Number of counts per unit time. *See:* **anticoincidence (radiation counters).** 190

counting-rate meter (pulse techniques). A device that indicates the time rate of occurrence of input pulses averaged over a time interval. *See:* **scintillation counter.** 117

counting rate versus voltage characteristic (gas-filled radiation-counter tube). The counting rate as a function of applied voltage for a given constant average intensity of radiation. 125



Counting rate-voltage characteristic in which

$$\text{Relative plateau slope} = 100\,\frac{\Delta C/C}{\Delta V}$$

$$\text{Normalized plateau slope} = \frac{\Delta C/\Delta V}{C'/V'} = \frac{\Delta C/C'}{\Delta V/V'}$$

country beam. *See:* **upper beams.**

country code (telephone switching systems). The one-, two-, or three-digit number that, in the world numbering plan, identifies each country or integrated numbering plan area in the world. The initial digit is always the world-zone number. Any subsequent digits in the code further define the designated geographical area normally identifying a specific country. On an international call, this code is dialed ahead of the national number. 55

counts, tube, multiple (radiation-counter tubes). *See:* **multiple tube counts.**

counts, tube, spurious (radiation-counter tubes). *See:* **spurious tube counts.**

couple (1) (storage cell). An element of a storage cell consisting of two plates, one positive and one negative. *Note:* The term couple is also applied to a positive and a negative plate connected together as one unit for installation in adjacent cells. *See:* **battery (primary or secondary); galvanic cell.** 328

(2) (thermoelectric). A thermoelectric device having two arms of dissimilar composition. *Note:* The term thermoelement is ambiguously used to refer to either a thermoelectric arm or to a thermoelectric couple, and its use is therefore not recommended. *See:* **thermoelectric device.** 191

coupled modes (fiber optics). Modes whose energies are shared. *See:* **mode.** 433

coupler (1)(navigation aid terms). That portion of a navigational system which receives signals of one type from a sensor and transmits signals of a different type to an actuator. *See:* **autopilot coupler.** 526

(2)(surge testing for equipment connected to low-voltage ac power circuits). A device, or combination of devices, used to feed a surge from a generator to powered equipment while limiting the flow of current from the power source into the generator. 578

(3) (fiber optics). *See:* **optical waveguide coupler.** 433

coupler, 3-decibel. *See:* **hybrid control.**

coupling (1)(ground system). The association of two or more circuits or systems in such a way that power or signal information may be transferred from one to another. *Note:* Coupling is described as close or loose. A close-coupled process has elements with small phase shift between specified variables; close-coupled systems have large mutual effect shown mathematically by cross-products in the system matrix. 313

(2) (rotating machinery). A part or combination of parts that connects two shafts for the purpose of transmitting torque or maintaining alignment of the two shafts. 63

(3) (data transmission). The association of two or more circuits or systems in such a way that power or signal information may be transferred from one to another. 59

(4) (software). A measure of the interdependence among modules in a computer program. *See:* **cohesion; computer program; module.** 434

(5) (waveguide). The power transfer from one transmission path to a particular mode or form in another. *Note:* Small, undesired coupling is sometimes called isolation, decoupling, or cross coupling. 267

coupling aperture (coupling hole, coupling slot) (waveguide components). An aperture in the bounding surface of a cavity resonator, waveguide, transmission line, or waveguide component which permits the flow of energy to or from an external circuit. 166

coupling capacitance.(1)(ground systems) The association of two or more circuits with one another by means of capacitance mutual to the circuits. 313

(2) (interference terminology). The type of coupling in which the mechanism is capacitance between the interference source and the signal system, that is, the

$$Q_v = \int \varphi_v dt)$$

(light emitting diodes). The product of the luminous flux by the time it is maintained. It is the time integral of luminous flux. 162

quantization (1) (telecommunication). A process in which the continuous range of values of an input signal is divided into nonoverlapping subranges, and to each subrange a discrete value of the output is uniquely assigned. Whenever the signal value falls within a given subrange, the output has the corresponding discrete value. *Note:* Quantized may be used as an adjacent modifying various forms of modulation, for example, quantized pulse-amplitude modulation. *See:* **quantization distortion (quantization noise); quantization level).** 415,255,77,194

(2) (gyro; accelerometer). The analog-to-digital conversion of a gyro or accelerometer output signal which gives an output that changes in discrete steps as the input varies continuously. 46

(3) (data transmission). In communication, quantization is a process in which the range of values of a wave is divided into a finite number of smaller subranges, each of which is represented by an assigned (or quantized) value within the subrange. *Note:* "Quantized" may be used as an adjective modifying various forms of modulation, for example, quantized pulse amplitude modulation. 59

quantization distortion (quantization noise) (data transmission). The inherent distortion introduced in the process of quantization. 59

quantization error (supervisory control, data acquisition, and automatic control). The amount that the digital quantity differs from the analog quantity. *See:* **analog-to-digital (a/d) conversion.** 570

quantization level (1) (data transmission). A particular subrange of a symbol designating it. 59

(2) (telecommunication). The discrete value of the output designating a particular subrange of the input. *See:* **quantization.** 242

quantization noise. *See:* **quantization distortion.**

quantize. To subdivide the range of values of a variable into a finite number of nonoverlapping subranges or intervals, each of which is represented by an assigned value within the subrange, for example, to represent a person's age as a number of whole years. 255,77

quantized pulse modulation. Pulse modulation that involves quantization. 328

quantized system. One in which at least one quantizing operation is present. 56

quantizing error (radar). An error caused by conversion of a variable having a continuous range of values to a quantized form having only discrete values, as in analog-to-digital conversion. The error is the difference between the original (analog) value and its quantized (digital) representation. *See:* **quantization; quantize.** 13

quantizing loss (radar). (1) In phased arrays, a loss that occurs when the beam is phase steered by digitally controlled phase shifters, due to the quantizing errors in the phase shifts applied to the various elements. (2) In signal processing, a loss that occurs when elements of a composite signal (for example, complex amplitudes of pulses in a pulse train) are quantized (digitized) before being combined. *See:* **quantizing error.** 13

quantizing noise (analog voice frequency circuits). The noise introduced during the process of digitally encoding an analog signal. 468

quantizing operation. One which converts one signal into another having a finite number of predetermined magnitude values. 56

quantum efficiency (1) (photocathodes). The average number of electrons photoelectrically emitted from the photocathode per incident photon of a given wavelength. *Note:* The quantum efficiency varies with the wavelength, angle of incidence, and polarization of the incident radiation. *See:* **photocathodes; photoelectric converter; phototubes; semiconductors.** 125,117

(2) (laser, maser, laser material, or maser material). The ratio of the number of photons or electrons emitted by a material at a given transition to the number of absorbed particles. 363

(3) (fiber optics). In an optical source or detector, the ratio of output quanta to input quanta. Input and output quanta need not both be photons. 433

quantum noise (fiber optics). Noise attributable to the discrete or particle nature of light. *Syn:* **photon noise.** 433

quantum-noise-limited operation (fiber optics). Operation wherein the minimum detectable signal is limited by quantum noise. *See:* **quantum noise.** 433

quarter-phase or two-phase circuit. A combination of circuits energized by alternating electromotive forces that differ in phase by a quarter of a cycle, that is, 90 degrees. *Note:* In practice the phases may vary several degrees from the specified angle. *See:* **center of distribution.** 64

quarters (electric installations on shipboard). Where used in these recommendations, those spaces provided for passengers or crew, as specified, which are actually used for berthing, mess spaces, offices, private baths, toilets and showers, and lounging rooms, smoking rooms, and similar spaces. 3

quarter-thermal-burden ambient-temperature rating. The maximum ambient temperature at which the transformer can be safely operated when the transformer is energized at rated voltage and frequency and is carrying 25 percent of its thermal-burden rating without exceeding the specified temperature limitations. 328

quartet (mathematics of computing). A group of four adjacent digits operated upon as a unit. 564

quasi-analog signal (data transmission). A digital signal after conversion to a form suitable for transmission over a specified analog channel. The specifications of an analog channel includes the frequency of range, frequency of bandwidth, signal-to-noise ratio (snr), and envelope delay distortion. When this form of sig-

EXHIBIT T

Amendment

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Long, Guozhu	EXAMINER:	Tse, Y.
SERIAL NO.:	08/097,343	GROUP:	2614
FILED:	07/23/93	CASE NO.:	CX092016
ENTITLED:	DEVICE AND METHOD FOR UTILIZING ZERO-PADDING CONSTELLATION SWITCHING WITH FRAME MAPPING		

Motorola, Inc.
Corporate Offices
1303 E. Algonquin Road
Schaumburg, IL 60196
February 1, 1995

SUPPLEMENTARY AMENDMENT AND RESPONSE UNDER 37 CFR 1.115

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

In response to a conference with Examiner Young Tse on 1/26/95, the Applicant hereby respectfully submit the following Supplementary Amendment and Response:

SUPPLEMENTARY AMENDMENT

In the Claims:

Please amend claims 5-8 to read as follows:

5. (Amended) A frame-mapping method for mapping successive frames of data to groups of N symbols, N a predetermined integer (N>1), such that, on average, a fractional number Q of bits are mappable per frame without constellation switching, comprising the steps of:

A) selecting a number of bits for each frame to be one of: J-1, J , where J is an integer such that J -1< Q < J , according to a predetermined pattern,

B) in frames of J-1 bits, inserting a zero in a most significant bit (MSB) position,

C) selecting a [signal constellation with] set of 2^J possible combinations of N symbols, where each symbol is chosen from a signal constellation [signal points each representing a possible group of N symbols], and

D) mapping the frame bits such that for MSB = 0, one of the 2^{J-1} [signal points] possible combinations of N symbols of least average energy is selected from the [signal constellation] set of 2^J possible combinations.

B1 Cont

6. (Amended) The frame-mapping method of claim 5 wherein :

A) the frame-mapping method is shell mapping,

[B) the signal constellation is a subset of the N-fold Cartesian product of a second signal constellation,]

B[C]) ~~the~~ [second] signal constellation is divided into M equal size rings, M an integer, each of which has 2^v (v>0 a predetermined integer) points, and

C[D]) where in frames of J-1 bits, K-1 (K = J-N•v) bits, together with a zero as the MSB, are utilized for shell mapping, to obtain N ring indices ranging from 0 to M-1 such that an average sum of N ring indices obtained in shell mapping is kept small, thereby keeping the average signal power small, and

D[E]) where in frames of J bits, K bits are utilized for shell mapping to obtain N ring indices.

7. (Amended) A frame-mapping device for mapping successive frames of data to groups of N symbols, N a predetermined integer (N>1), such that, on

average, a fractional number Q of bits are mappable per frame without constellation switching, comprising:

A) a frame selector, operably coupled to receive the data, for selecting a number of bits for each frame of data to be one of: J-1, J, where J is an integer such that J -1< Q < J, according to a predetermined pattern,

B) a zero insertion unit, operably coupled to the frame selector, for, in frames of J-1 bits, inserting a zero in a most significant bit (MSB) position,

C) a signal constellation selector/mapper, operably coupled to the zero insertion unit, for selecting a [signal constellation with] set of 2^J possible combinations of N symbols, where each symbol is chosen from a signal constellation [signal points each representing a possible group of N symbols], and mapping the frame bits such that for MSB = 0, one of 2^{J-1} [signal points] possible combinations of N symbols of least average energy is selected from the [signal constellation] set of 2^J possible combinations.

B1 Ord Cl

8. (Amended) The frame-mapping device of claim 7 wherein:

A) the frame-mapping device is a shell mapper,

[B) the signal constellation is a subset of an N-fold Cartesian product of a second signal constellation,]

B[C]) the number of bits in each frame is one of: J-1 and J,

C[D]) where in frames of J-1 bits, K-1 (K = J-N·v) bits, together with a zero as the MSB, are utilized for shell mapping to obtain N ring indices ranging from 0 to M-1 (M being an integer) such that an average sum of N ring indices obtained in shell mapping is minimized, thereby minimizing an average signal power, and

D[E]) where in frames having a total of J bits, K bits are utilized for shell mapping to obtain N ring indices.

REMARKS

26

In the phone conference with Examiner Tse on 1/26/95, the Examiner submitted:

1) The equations on line 27 of page 10 and line 13 of page 11 were unclear since each equation had a same symbol on both sides of the equals sign and further terms on one side only, a terminology that he submitted is inaccurate. It was explained that the terminology for the equations on line 27 of page 10 and line 13 of page 11 is terminology specific to computer software technology and is known to those skilled in the art. For example, this terminology is utilized in determining a radix-2 decimation-in-time FFT, as is set forth in Chart 1 page 28-24 of the <u>REFERENCE DATA FOR ENGINEERS: Radio, Electronics, Computer & Communications</u>, 8th Edition, SAMS Prentice Hall Computer Publishing, 1993. A copy of pages 28-22 through 28-25 of said reference are included herewith for the Examiner's convenience. Note that in Chart 1 :

j = j - n1
n1 = n1/2
j = j + n1
etc.

Thus, the terminology of the equations on line 27 of page 10 and line 13 of page 11 is believed to be clear to those skilled in the art.

Since the Examiner objected to the terminology of 6B and 8B, the Applicant has deleted the terminology "the signal constellation is a subset of the N-fold Cartesian product of a second signal constellation" of claims 6B and 8B, and has amended claims 5 and 7 for clarification.

Thus, since the Examiner submitted that claims 1-4 were in condition for allowance, and the Applicant has amended claims 5-8 to eliminate the terminology objected to by the Examiner, Applicant respectfully submits that claims 1-8 are now in a form for allowance.

Allowance of the specification and claims 1-8 is hereby

respectfully requested.

Respectfully submitted,

Guozhu Long

By Darleen J. Stockley

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These block filtering algorithms make it possible to filter continual data streams in real time because the efficiency of the FFT minimizes the total computation time and can achieve reasonably high overall data rates. However, block filtering generates data in bursts; i.e., there is a delay during which no filtered data appears, and then suddenly an entire block is generated. In real-time systems, buffering must be used. The block algorithms are particularly effective for filtering very long sequences of data that are prerecorded on tape or magnetic disk.

FFT Algorithms

"Fast Fourier transform" (FFT) is a generic name for a class of algorithms that efficiently compute the DFT (see Eqs. 34). The FFT is easily understood by examining a radix-2 FFT for the case $N = 2^3$. First, each of the indices k and n can be expressed in binary form, $k = k_2 4 + k_1 2 + k_0$ and $n = n_2 4 + n_1 2 + n_0$, where k_i and n_i are bits that take the values of either 0 or 1. If these expressions are substituted into Eq. 34a, all terms in the exponent that contain the factor $N = 8$ can be simply deleted, because $e^{j2\pi l} = 1$ for any integer l. Upon deleting such terms and regrouping, the product nk can be expressed in one of two ways:

$$nk = (4k_0)n_2 + (4k_1 + 2k_0)n_1 + (4k_2 + 2k_1 + k_0)\,n_0 \qquad \text{(Eq. 35a)}$$

$$nk = (4n_0)k_2 + (4n_1 + 2n_0)k_1 + (4n_2 + 2n_1 + n_0)k_0 \qquad \text{(Eq. 35b)}$$

Substituting Eq. 35a into Eq. 34a leads to the decimation-in-time (D-I-T) FFT, whereas substituting Eq. 35b into Eq. 34a leads to the decimation-in-frequency (D-I-F) FFT. Only the D-I-T FFT is discussed further here. The D-I-F FFT and various related forms are treated in detail in reference 6.

The D-I-T FFT decomposes into $\log_2 N$ stages of computation, plus a stage of bit reversal. (Let $W_N = e^{j2\pi/N}$.)

$$x_1(k_0,n_1,n_0) = \sum_{n_2=0}^{1} x(n_2,n_1,n_0)W_8^{4k_0n_2} \qquad \text{(stage 1)}$$

$$x_2(k_0,k_1,n_0) = \sum_{n_1=0}^{1} x_1(k_0,n_1,n_0)W_8^{(4k_1+2k_0)n_1} \qquad \text{(stage 2)}$$

$$x_3(k_0,k_1,k_2) = \sum_{n_0=0}^{1} x_2(k_0,k_1,n_0)W_8^{(4k_2+2k_1+k_0)n_0} \qquad \text{(stage 3)}$$

$$X(k_2,k_1,k_0) = x_3(k_0,k_1,k_2) \qquad \text{(bit reversal)}$$

In each summation above, one of the n_i's is summed out of the expression, while at the same time a new k_i is introduced. The notation is chosen to reflect this. For example, in stage 3, n_0 is summed out, k_2 is introduced as a new variable, and n_0 is replaced by k_2 in the result. The last operation, called bit reversal, is necessary to correctly locate the frequency samples $X(k)$ in the memory. It is easy to show that if the samples are paired correctly, an in-place computation can be done by a sequence of butterfly computations. For example, in stage 3 the $k = 6$ and $k = 7$ samples should be paired, yielding a butterfly computation that requires one complex multiply, one complex add, and one complex subtract.

$$x_3(1,1,0) = x_2(1,1,0) + W_8^3\, x_2(1,1,1)$$

$$x_3(1,1,1) = x_2(1,1,0) - W_8^3\, x_2(1,1,1)$$

Therefore samples $x_2(6)$ and $x_2(7)$ are read from memory, the butterfly is executed, and $x_3(6)$ and $x_3(7)$ are written back to memory, thereby destroying the original values of $x_2(6)$ and $x_2(7)$. In general, there are $N/2$ butterflies per stage and $\log_2 N$ stages, so the total number of butterflies is $(N/2)\log_2 N$. Since there is at most one complex multiply per butterfly, the total number of multiplies is bounded by $(N/2)\log_2 N$ (some of the multiplies involve factors of 1, and should not be counted). A direct computation of the DFT requires on the order of N^2 complex multiplies. It is obvious that for large N, the order of complexity of the FFT, $0[(N/2)\log_2 N]$, is much less than the order of complexity $0(N^2)$ of the DFT. The saving is so dramatic for large N that the FFT has made possible the solution of many DSP problems that are compute-bound and impossible to solve with the direct DFT.

Fig. 28 shows the signal-flow graph for the D-I-T FFT with $N = 8$, which is referred to as an in-place FFT with normally ordered input and bit reversed output. Minor variations that include bit reversed input and normally ordered output, and non-in-place algorithms with normally ordered inputs and outputs are possible. Also, when N is not a power of 2, a mixed-radix algorithm can be used to reduce computation.† The mixed-radix FFT is most efficient when N is highly composite, i.e., $N = \prod_{i=1}^{L} p_i^{r_i}$ where the p_i's are small primes and the r_i's are positive integers. It can be shown that the order of complexity of the mixed-radix FFT is $0\left\{N\sum_{i=1}^{L} r_i(p_i - 1)\right\}$. Because of the lack of uniformity of structure among stages, this algorithm has not received much attention for hardware implementation. However, the mixed-radix FFT is often used in software applications, especially for processing data recorded in laboratory experiments where it is not convenient to restrict the block lengths to be powers of 2. The most

† Reference 46.

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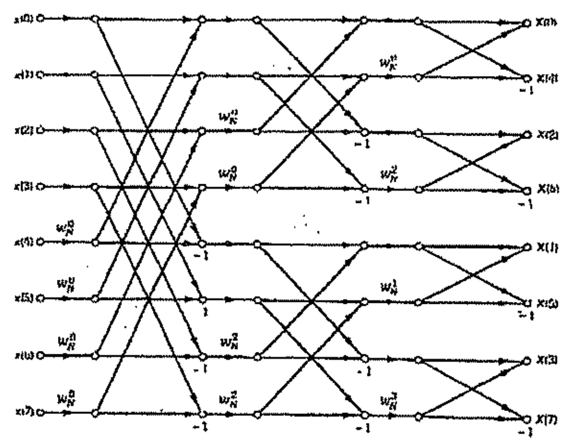

Fig. 28. Decimation-in-time FFT algorithm with normally ordered inputs and bit reversed output.

widely used mixed-radix FFT program was published by Singleton.† Singleton's program is also contained in the collection of DSP programs published by the IEEE Acoustics, Speech, and Signal Processing Society.§

Other advanced algorithms, such as higher-radix algorithms and the prime-factor algorithm, are described in reference 8. Algorithms specialized for real-valued data, discussed in reference 47, reduce the computational cost by a factor of two.

A radix-2 decimation-in-time FFT program, written in C, is listed in Chart 1 for reference.

The FFT in Spectral Analysis

An FFT program is often used to perform spectral analysis on signals that are sampled and recorded as part of laboratory experiments, or in certain types of data acquisition systems. There are several issues that should be addressed when spectral analysis is performed on (sampled) analog waveforms that are observed over a finite interval of time.

Windowing—The FFT treats the block of data as though it is one period of a periodic sequence. If the underlying waveform is not periodic, then harmonic distortion may occur because the periodic waveform "created by the FFT" may have sharp discontinuities. This effect is minimized by removing the mean of the data (it can always be reinserted) and by windowing the data so the ends of the block are smoothly tapered to zero and discontinuities do not occur when the FFT treats the windowed block as one period of a periodic sequence. A good rule of thumb is to taper 10 percent of the data on each end of the block using either a cosine taper or one of the other common windows from Table 3.‡ An alternate interpretation of this phenomenon is that the finite length observation has already windowed the true waveform with a rectangular window that has large spectral side lobes. Hence, applying an additional window results in a more desirable window that minimizes frequency-domain distortion.

Zero-Padding—It would appear that more accuracy is produced in the spectral domain if the block length of the FFT is increased. This can be done by (1) taking more samples within the observation interval, (2) increasing the length of the observation interval, without increasing the sampling rate, or (3) augmenting the original data set with zeros. First, it must be recognized that the finite observation interval causes a fundamental limit on the spectral resolution, even before the signals are sampled. The CT rectangular window has a $\sin x/x$ spectrum, which is convolved with the true spectrum of the analog signal that is being observed. Therefore, frequency resolution is limited by the width of the main lobe in the $\sin x/x$ spectrum, which is inversely proportional to the length of the observation interval. Sampling causes a certain degree of aliasing, although this effect can be minimized by sampling at a high enough rate. Therefore, lengthening the observation interval increases the fundamental resolution limit, while taking more samples within the same observation interval

† Reference 46.
§ Reference 43.

‡ Reference 20.

CHART I. AN IN-PLACE D-I-T FFT PROGRAM IN C

```
/********************************************************************/
/*    fft: in-place radix-2 DIT DFT of a complex input              */
/*                                                                  */
/*    input:                                                        */
/*       n:       length of FFT: must be a power of two             */
/*       m:       n = 2**m                                          */
/*    input/output:                                                 */
/*       x:       float array of length n with real part of data    */
/*       y:       float array of length n with imag part of data    */
/********************************************************************/
fft(n,m,x,y)
int     n,m;
float   x[],y[];
{
        int     i,j,k,n1,n2;
        float   c,s,e,a,t1,t2;

        j = 0;                              /* BIT-REVERSE  */
        n2 = n/2;
        for (i=1; i < n - 1; i++)                /* bit-reverse counter */
        {
          n1 = n2;
          while ( j >= n1 )
           {
            j = j - n1;
            n1 = n1/2;
           }
          j = j + n1;

          if (i < j)                             /* swap data */
           {
            t1 = x[i];  x[i] = x[j];  x[j] = t1;
            t1 = y[i];  y[i] = y[j];  y[j] = t1;
           }
         }

        n1 = 0;  n2 = 1;                    /* FFT  */

        for (i=0; i < m; i++)                   /* stage loop */
         {
          n1 = n2;  n2 = n2 + n2;
          e = -6.283185307179586/n2;
          a = 0.0;

          for (j=0; j < n1; j++)                /* flight loop */
           {
            c = cos(a);  s = sin(a);
            a = a + e;

            for (k=j; k < n; k=k+n2)            /* butterfly loop */
             {
              t1 = c*x[k+n1] - s*y[k+n1];
              t2 = s*x[k+n1] + c*y[k+n1];
              x[k+n1] = x[k] - t1;
              y[k+n1] = y[k] - t2;
              x[k] = x[k] + t1;
              y[k] = y[k] + t2;
             }
           }
         }
        return;
}
```

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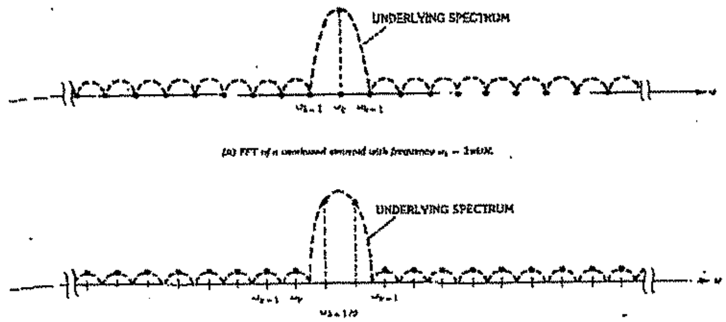

(A) FFT of a windowed sinusoid with frequency $\omega_k = 2\pi k/N$.

(B) Leakage for a nonharmonic sinusoidal component.

Fig. 29. Picket-fence effect.

minimizes aliasing distortion and provides a better definition (more sample points) on the underlying spectrum.

Padding the data with zeros and computing a longer FFT does give more frequency domain points, but it does not improve the fundamental resolution limit, nor does it alter the effects of aliasing. The resolution limits are established by the observation interval and the sampling rate. No amount of zero padding can improve these basic limits. However, zero padding is a useful tool for providing more spectral definition; i.e., it enables one to get a better look at the (distorted) spectrum that exists after the observation and sampling effects have occurred.

Leakage and the Picket-Fence Effect—An FFT with block length N can accurately resolve only frequencies $\omega_k = (2\pi/N)k$, $k = 0, \ldots, N-1$ that are harmonics of the fundamental, $\omega_1 = 2\pi/N$. An analog waveform that is sampled and subjected to spectral analysis may have frequency components between the harmonics. A component at frequency $\omega_{k+1/2} = (2\pi/N)(k + \frac{1}{2})$ will appear to be scattered throughout the spectrum. The effect is illustrated in Fig. 29 for a sinusoid that is observed through a rectangular window and then sampled at N points. The "picket-fence effect" means that not all frequencies can be seen by the FFT. Harmonic components are seen accurately. Other components "slip through the picket fence" while their energy is "leaked" in the harmonics.† These effects produce artifacts in the spectral domain that must be carefully monitored to assure that an accurate spectrum is obtained from FFT processing.

† Reference 5.

DISCRETE-TIME ANALOG TECHNOLOGIES

The most obvious implementation of discrete-time filters is with digital technology. However, filters operating at very high bandwidths can require more than 10^9 taps per second, and digital implementations become very expensive in terms of cost, size, and power consumption. Several discrete-time analog technologies have been developed which compute discrete-time filters via analog means, thus avoiding explicit analog-to-digital conversion. Although they lack some of the flexibility of a digital implementation, these technologies have found application in a number of specialized cost-sensitive or high-bandwidth applications. Filter coefficients for these technologies are obtained by using the filter design methods described earlier. The basic filtering operation can also accomplish other tasks such as radar pulse detection and compression, communication channel equalization, signal generation, and pattern matching.

Three discrete-time analog technologies are discussed here. Switched Capacitor Filters (SCF), which implement IIR filters at relatively low bandwidths (up to about 10 MHz), are often a cost-effective alternative to an all-digital implementation. SCFs inherently sample the analog signal and thus exhibit spectral aliasing. Surface Acoustic Wave (SAW) devices implement FIR filters with nonadjustable coefficients at very high bandwidths, and are widely used in very high frequency systems such as radars and televisions. SAW devices process the continuous signal without sampling and thus produce no aliasing errors, but the filter is discrete and the frequency response exhibits spectral periodicity. Acoustic Charge Transport (ACT) devices support FIR filters with *programmable* coefficients at bandwidths

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

CERTIFICATE OF SERVICE

I, Philip A. Rovner, hereby certify that on May 23, 2008, the within document was filed with the Clerk of the Court using CM/ECF; that the document was served on the following party as indicated; and that the document is available for viewing and downloading from CM/ECF.

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